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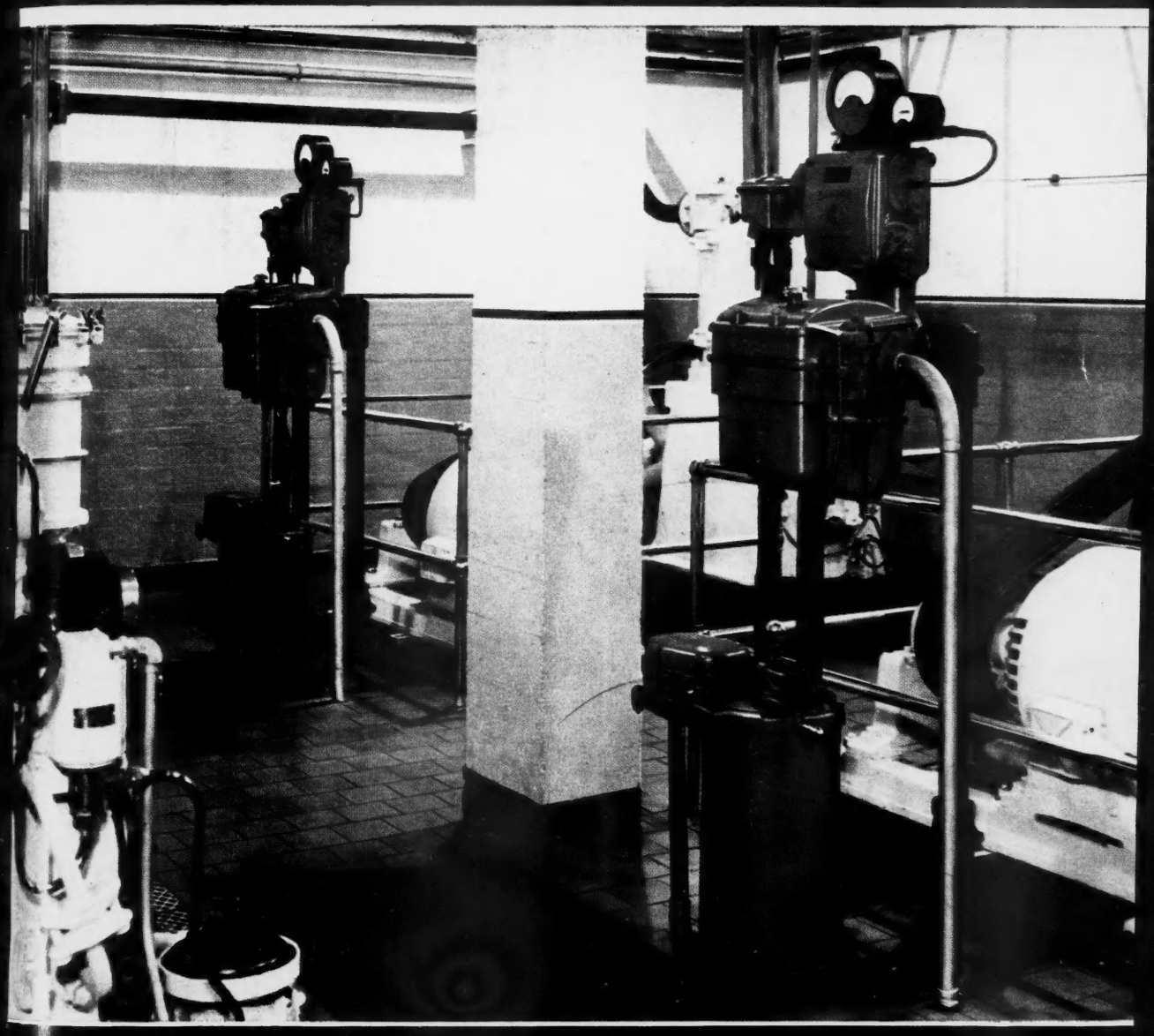

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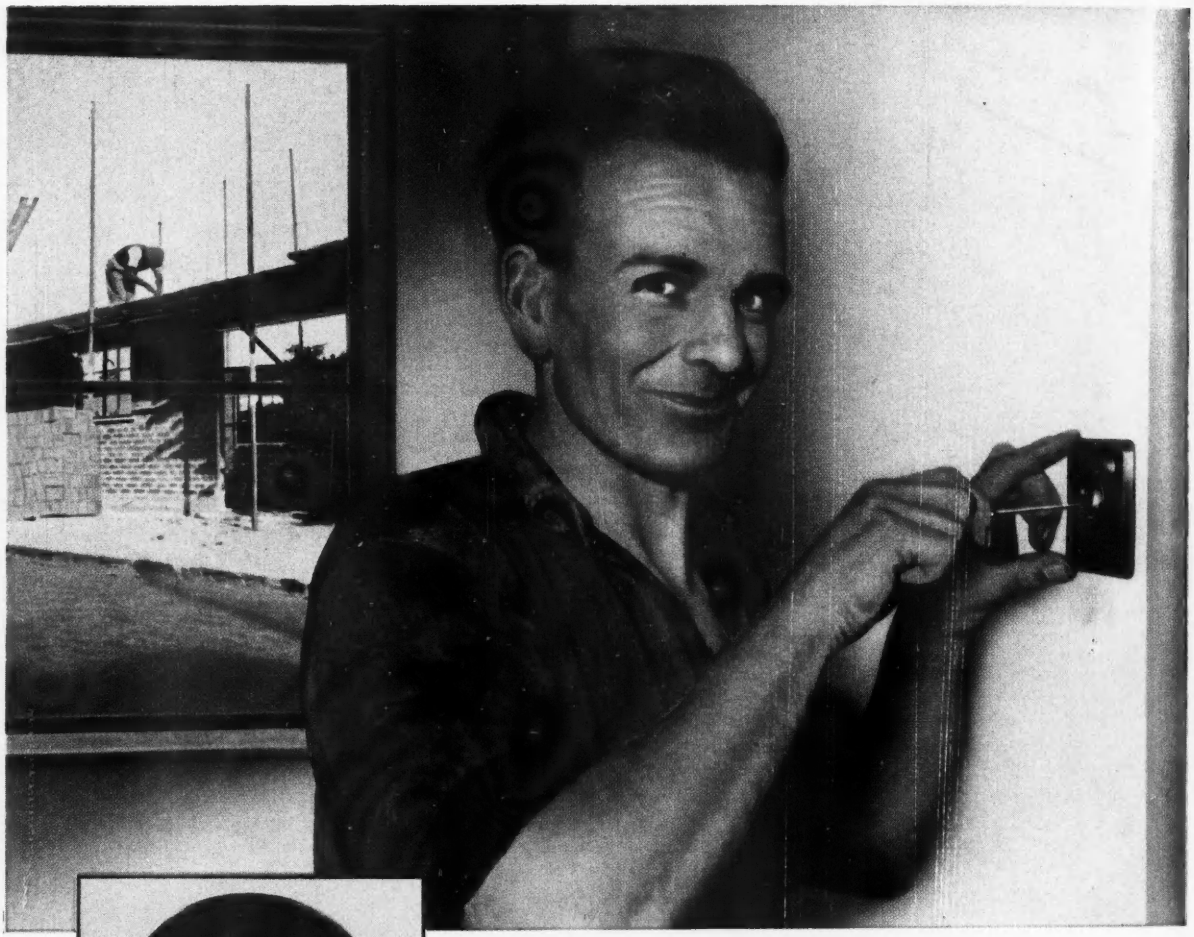

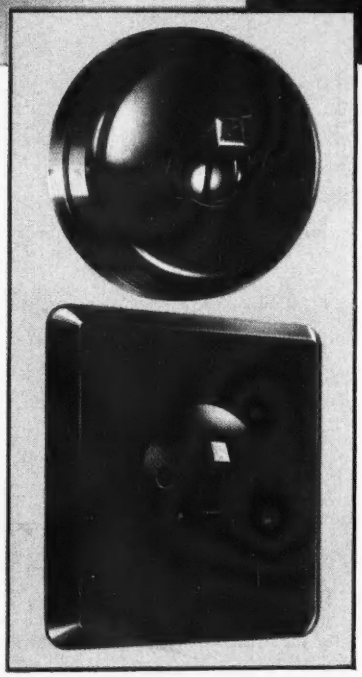

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ELECTRICAL REVIEW

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18 FEBRUARY 1955

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VOLUME 156 ✧ NUMBER 7

Eighty-Third Year of Publication

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ELECTRICAL REVIEW

18 February 1955 Vol. 156 No. 7 Established 1872

Network Industrial Supplies

WITH the trend during the past twenty years or so for heavy industry to become more and more dispersed we have become increasingly familiar with the pattern of heavily loaded factories each having its own individual electricity service from the public supply system, often in the form of a high voltage supply line serving the factory direct from a substation a considerable distance away. This has given rise to the general picture of the greater part of the urban, commercial and industrial areas of the country being served by low voltage and high voltage systems, while the majority of the larger factories are supplied independently of distribution networks.

While this picture is substantially correct there are important exceptions. We refer in particular to certain localities, each usually devoted to one particular industry, where industrial production is so highly concentrated as to make network supply essential. The load density in these exceptional areas is often of the order of 100,000 kW per square mile and the significance of this figure lies in the fact that, as shown in the " Generation in Great Britain " map in the *Electrical Review* of 5th June, 1953, with its load density background on a Sub-Area basis, by far the greater part of the territory in Great Britain has a load density of under 250 kW per square mile.

Elsewhere in this issue Mr. A. Haddock, manager of the No. 3 (Sheffield) Sub-Area of the Yorkshire Electricity Board, writes forcibly on the problems associated with distribution in this type of densely industrial area, with particular reference to Sheffield with its concentration of steelworks. The author rightly draws particular attention to the prime importance of security of supply in such areas, and to the necessity of providing alternative supplies.

We agree that the underground cable network affords the greater security in distribution of this class; indeed we think that it is the only practical proposition in such heavy industrial areas, but, as the author points out, one of the major problems of distribution in a densely developed area is the physical accommodation of the cables in the ground, not only in respect of the number of cables which must often be laid in close proximity one to another, with consequent reduced ratings, but also because of the presence of water and gas mains, telephone cables, etc., and here is one aspect of the importance of using even higher voltages and developing cables accordingly.

Disposition, lay-out and equipment of substations also have an important bearing on security of supply, and here we may draw attention to the similarity of the problems of distribution in the heavy industry areas and those of distribution in heavily loaded commercial areas like Central London where the load density is approaching 100,000 kW for its square mile. The new substation of the London Electricity Board which is described elsewhere in this issue, with its underground switchgear, is a good example of a substation built for such conditions.

NATIONAL INSPECTION COUNCIL

Ever since the electricity supply industry was nationalized the inspection of electrical installations has been under consideration. There already existed the National Register of Electrical Installation Contractors, which was regarded as a possible nucleus for a new, more comprehensive, system. Agreement between the electricity authorities and the electrical contractors' organizations upon the form and functions of a new Inspection Council has seemed imminent on two or three occasions but still nothing came forth. Now, after several years of discussion, the Organizing Committee appointed for the purpose is able to report that agreement has been reached. As was generally expected, the new Inspection Council for Electrical Installation Contracting is to maintain a roll or register of contractors who have shown their ability to carry out good work and agree to abide by the Council's rules and regulations; it will issue certificates to these contractors (and cancel or withdraw them if necessary). It will set up an inspection system; educate the public in installation matters; and encourage improved methods of securing safe installations and appliances. Presumably details have been thoroughly discussed and so the establishment of the Council and an announcement of its proposed methods of operation should not be long forthcoming.

BULK SUPPLY TARIFF

An announcement by the British Electricity Authority published in this issue sets out the terms of the Authority's 1955-56 tariff for supplies to the twelve Area Boards (i.e., excluding Scotland). Although basically the same as for the current year, the new tariff contains two modifications of some significance. First, while the fixed charge remains at £4 15s per kW of simultaneous maximum demand, the Boards' actual demand figures are now to be more closely related to the estimate on which the kilowatt charge is based, namely, 16,630,000 kW. The formula is that where the sum of the Boards' demands and those of other direct consumers varies by more than one per cent from the estimated total demand, the individual demands of the Boards are to be adjusted inversely. The effect of this will be to minimize the consequences of extreme weather conditions on the Boards' operating results. Last year, for example, exceptional increases in the Boards' maximum demands owing to a short cold spell were the main reason for the Authority's higher surplus. The second alteration is in the fuel price adjustment. This is to be further lowered to 0·0006d per penny variation in the price of fuel per ton, reflecting the benefits of greater thermal efficiency of power stations.

BASIS OF PROGRESS

Broad engineering significance was given by Sir Claude Gibb to his report on the mishap which entailed damage to two 100 MW alternators in Canada in the aphorism with which he prefaced his paper before the Institution of Mechanical Engineers (summarized in this issue). Implementing his view that "progress is made by solving the problems resulting from the making of progress," he gave a step-by-step account of the sifting of all the available evidence by engineers, metallurgists and mathematicians as they traced the cause of the trouble to a relatively minor component. This report, we have no doubt, will be of the greatest value to manufacturers of machines of advanced design and will reinforce confidence abroad in the vast technological resources of this country.

THE RAILWAY PLAN

Some of the speakers in last week's Commons debate on the second reading of the Transport (Borrowing Powers) Bill expressed uncertainty of the Government's attitude towards the British Transport Commission's Plan for the Modernization and Re-equipment of the Railways. In winding up the debate Mr. Molson, Joint Parliamentary Secretary, Ministry of Transport, said he thought that the Government's acceptance of the Plan had already been made clear by the Chancellor of the Exchequer. There seemed to be no opponents of the plan on either side of the House although some aspects and estimates were questioned. It was seen that three possible limiting factors were finance, technical staff and manufacturing capacity. The cost of the Plan was not generally regarded as excessive for the benefits it would bring. As regards the second, the railways are not the only sufferers from the chronic shortage of capable designers and engineers. They are affected particularly in civil engineering—the predominant side of railway work. On the mechanical side they are strong and, in any event, both for mechanical and electrical aid they can call upon the technical staffs of outside manufacturers. It has already been authoritatively asserted in the *Electrical Review* that the electrical manufacturers, at least, are capable of taking on the burden which the Plan will impose (or an even bigger one). Replying to a suggestion by Viscount Hinchingbrooke, Mr. Molson said that while it would be open to anyone to tender for diesels (the term includes diesel-electrics) he had no doubt that British makers, who were exporting diesels to all parts of the world, would be able to compete successfully against any foreign offers.

FLUE-GAS WASHING

Conclusions drawn from wind-tunnel experiments described by Messrs. L. W. Bryant and C. F. Cowdrey at the Institution of Mechanical Engineers and reported in this issue indicate that the advantages of flue-gas washing in reducing sulphur-dioxide concentration on the ground are obtainable only at high wind velocities and turbulence (i.e. in no-fog conditions) and that these are experienced on very few days in the year. At wind speeds normally found the effects of gas washing were found to be decidedly adverse, especially in the immediate neighbourhood of power stations, new examples of which have chimneys upwards of 300ft tall. It was shown that gas washing would present advantages only when it is necessary to take account of the greater sulphur-dioxide concentrations which occur at atmospheric levels comparable with chimney height at points close to the power station.

Electricity Supply to Heavy Industry

Problems Encountered in Dense Industrial Areas

By A. HADDOCK, B.Sc., M.I.E.E.*

IN some parts of industrial England and Scotland there are dense concentrations of heavy industry. Electrical development in these localities is correspondingly heavy, the load density often exceeding 100 MVA per square mile. Few of the works in this type of area can take their electricity supply from the medium voltage distribution network. Many require an 11 kV supply into one or more works substations, and the very large works may be supplied by two or more 33 kV feeders of, say, 15 or 20 MVA capacity direct from power station or grid bulk supply point to works substation. These conditions present a number of problems not usually met with in a neighbourhood containing a blend of residential, commercial and light industrial property.

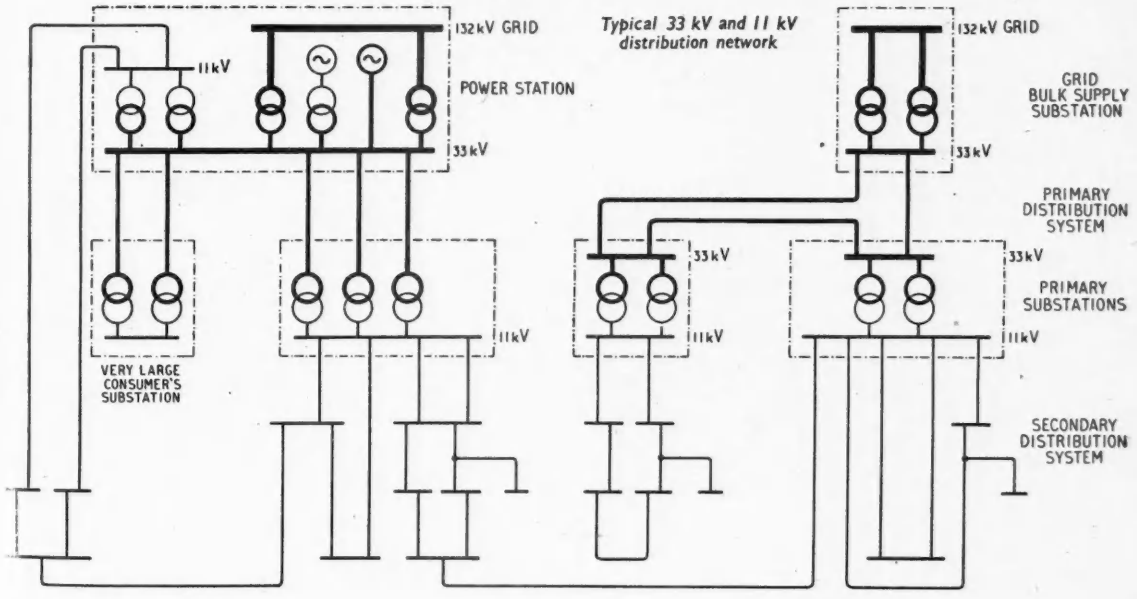
Distribution System

The primary distribution is usually by 33 kV underground cables originating in a power station or grid bulk supply substation and terminating in 33/11 kV substations. These primary substations will be either on works premises in the case of very large consumers, or on the supply authorities' own sites located in positions suitable for secondary distribution. Secondary distribution is by either 6·6 kV or 11 kV underground cables. Modern practice is to standardize on 11 kV, and 6·6 kV exists only as a survival of previous practice. The secondary distributors originate in primary distribution substations, but where power stations are located in the densely developed area, 11 kV distribution from the power station will supply the area in the immediate vicinity of the power station. The design of the distribution system is often influenced by the fact that it started as an 11 kV system and had a 33 kV system superimposed upon it when growth of load made this necessary and development of 33 kV cables made it possible. Ideally designed systems are consequently rare, but modern practice favours an arrangement where each 11 kV distribution system originates in its own primary substation and is comparatively self-contained, with only a small degree of interconnection between systems. The diagram shows the arrangement.

Security of supply is of prime importance. Where distribution is by means of underground cable security is normally good. Nevertheless breakdown of cable, switchgear or transformers does occur and consideration has to be given to the provision of alternative supplies to ensure that plants employing large numbers of workpeople and carrying out important processes shall not be shut down. On the 33 kV primary system the aim should be full security, permitting one fault to occur without interrupting supply or making load reduction necessary. A primary substation containing two 15 MVA transformers and fed by two 33 kV feeders could carry a load of 15 MVA and be operated with feeders and transformers in parallel. On the occurrence of a fault automatic protection clears the faulty feeder or transformer, or both, and full supply is maintained on the healthy plant.

More economical use is made of installed plant if the transformer and associated cables and other gear have an emergency short-time overload rating. Typical overload rating figures for 15 MVA transformers are 23 MVA for three hours, a time usually sufficient to allow of some load redistribution by switching. Such a substation could be regarded as providing a secure supply for a 23 MVA load.

* Mr. Haddock is manager, No. 3 (Sheffield) Sub Area, Yorkshire Electricity Board.



Load growth is compelling the development of the three-transformer substation, and thereby introducing additional problems such as increase in potential fault levels on the 11 kV system if the three transformers are operated in parallel. Possible solutions of this problem are referred to later.

With full security at the primary substations, supply to the 11 kV secondary distributions fed from the primary substations can be considered assured. A substation with two incoming 11 kV feeders, each capable of supplying the full substation load, is, therefore, considered to have a "firm" supply. Before the last war many undertakings tried to provide this degree of security to substations with a load in excess of 200 kVA, but economic considerations have now raised this limit to the neighbourhood of 1,000 kVA. Even so the very denseness of development, and the need to sectionalize the heavily loaded 11 kV network, will often result in the cable being looped into a substation with a load well below 1,000 kVA, a duplicate supply thus being provided.

For loads up to 3,000 or 4,000 kVA, resumption of supply along a healthy feeder following an interruption due to a fault cannot usually be effected without some switching on the distribution system. With loads approaching 5,000 kVA, duplicate 11 kV feeders with discriminative protection are justified, providing a "firm" supply which is not interrupted by one fault.

The number of substations to which supply is automatically maintained on the occurrence of a fault is a small proportion of the whole. Provision must, therefore, be made for rapid attention by operation engineers when breakdown interrupts supplies. A control centre with 24-hour engineering attendance, enabling an engineer to proceed immediately by rapid transport to the site of the trouble, is essential. His function is not to repair, but to isolate faulty equipment and to resume supplies along healthy routes. An ever-available rapid service of this type is an invaluable contribution to security of supply.

Accommodation of Cables

One of the major problems of distribution in a densely developed area is the physical accommodation of the cables in the ground. All but a small percentage of cables are laid in the public highway, and these same highways accommodate the pipes and cables of the other public utilities. Gas and water pipes of one or two feet in diameter, and sewers of much greater diameter, occupy much room. Post Office telephone cables take their quota, and in places hot water and steam pipes are encountered. Cables laid in the ground also require a large amount of room, since they must be laid sufficiently far apart for each cable to be unaffected by the heat generated by adjacent cables. The rating of four cables laid direct in the ground at a spacing of 12 inches between cables is reduced to approximately 75 per cent of maximum continuous rating.

Practical considerations of accessibility for initial jointing and repair limit the extent to which cables can be laid one above the other, and such an arrangement is better avoided in the case of 33 kV cables. It is practicable with 11 kV cables, particularly if the cables are drawn into nests of pipes and jointed in draw boxes, but this grouping of cables together in nests of pipes results in a considerable reduction in their rating, up to 50 per cent in the worst cases, and must, therefore, be regarded as a last resort.

These difficulties can only be overcome by the most careful advance planning before a new cable is laid. The proposed route must be thoroughly surveyed in consultation with the other public services, since there will be many places which are congested by gas and water pipes, sewers

Congestion of services in a highly developed area

and telephone cables. For 33 kV cables, jointing positions capable of accommodating the somewhat bulky joints must be most carefully chosen, and where more than one cable is to be laid on the same route, these jointing positions will often need to be staggered, because of the need for space. Cable is, of course, ordered in lengths to suit predetermined jointing positions.

Despite the most careful planning, there are places where adequate spacing from other cables cannot be obtained. The size of the cable is increased in such places to a size which, having regard to the conditions, produces the same rating as the remainder of the feeder. If, as is to be preferred, the cable is laid direct in the ground for most of its length, there will be some places where it must be laid in a protective pipe to guard against heavy traffic. Lengths in pipes are also increased in size in order to retain the full rating.

A particular problem arises when the cable route passes over a bridge. A scheme at present in course of preparation involves the laying of a number of 33 kV cables over twelve bridges. In two of these cases, there are seven cables in the track. It is usually not possible to accommodate this number of cables with adequate cover and suitable spacing in the footpath and carriageway of a bridge, and special cable-carrying supports are being incorporated in the bridge structure. It is, therefore, absolutely essential in the planning stage of such schemes to meet and consult with the highway and bridge authorities, so as to agree on a method satisfactory to all parties for accommodating the cables on the bridges. When bridge reconstruction is being undertaken to meet changed traffic conditions, the opportunity must be taken in co-operation with the bridge authorities for provision for cables during reconstruction. If not immediately required, the space can be reserved, perhaps by the insertion of pipes.

Outlets from power stations present particular difficulties, since the number of outlets is limited by the proximity of river, railway and canal, and the number of cables to be accommodated is often large, twenty 33 kV and ten 11 kV cables being typical. Additional outlets have been found by using railway tracks and canals as routes. These transport routes serve industry and therefore go where the cables need to go. On canals the cable is laid underground in the towpath and in the canal margin. Ample warning notices of its presence are necessary to guard against danger from driven mooring pins. On the railway it can, in suitable cases, be laid overground, on

concrete supports, but a problem arises with gas-filled cables in localities where the atmosphere is corrosive. Damage occurs to the cable serving due to a variety of causes, and admits moisture and corrosion to the armour which reinforces the lead sheath. If corrosion makes much progress before the damage is discovered and remedied, the reinforcing will be so weakened that the lead will burst under the internal gas pressure. This is also a possible difficulty with oil-filled cables. Still further outlets have been made by the judicious use of cable bridges to carry the cable across the river near the power station, so enabling any possible route that is clear of congested roadways to be used.

The need to transmit large blocks of power to heavy industry has led to the extensive use of 33 kV cables, and the difficulty of finding room for sufficient cables in congested places has made it important that each cable shall have as high a rating as possible. Considerations of physical size have led to the extensive use of ·30 sq in 3-core 33 kV cable with a solid dielectric which, when laid direct in the ground, has a rating of 20 MVA. Development of gas-filled and oil-filled cables, with their thinner dielectrics and better thermal characteristics, has enabled a ·40 sq in 3-core cable to be made to approximately the same physical dimensions, but with a rating under similar conditions of 28 MVA. These cables are more costly than solid dielectric cables, but in dense areas feeders are short, and the expensive circuit breaker at the power station end represents a substantial part of the total cost. Under these conditions, gas-filled or oil-filled 33 kV cables compare favourably with solid dielectric cables in terms of total feeder cost per kVA transmitted.

Secondary Distribution

The commonest size of 11 kV cable used on the secondary distribution is either ·25 or ·30 sq in 3-core,

33 kV joint bay showing the extent of the space required

with a rating of approximately 6,000 and 7,000 kVA respectively. The rating is, of course, much affected by the method of laying, grouping and armouring. Some ·10 sq in 3-core cable is used, but load considerations limit its use to branch circuits and transformer primaries. The level of potential fault kVA is too high in these densely developed areas to permit the use of any smaller size, as the cable would be in danger of damage by the magnitude of current on the occurrence of a fault.

These cables are also laid direct in the ground where possible, as this gives the highest rating and the best service, but the 11 kV secondary distribution cables have to be got right into the load centre of industrial establishments, and difficult ground conditions and the need to lay cables under roadways and workshops carrying heavy traffic and plant, often compel the laying of cables in pipes. This has resulted in many miles of cables being so installed in the past.

Substations pose a difficult problem in the finding of somewhere to establish them. Dense development means that there is little or no spare ground. So far as the supply authority's own sites are concerned, needs must be appreciated well ahead, and sites obtained when town planning proposals or demolition make them available in the required positions.

On works sites, convincing arguments must be advanced to persuade the consumer to allocate adequate space in a suitable position. A suitable position is one to which there is access for heavy equipment from the nearest road or railway; to which there is a reasonable route for the supply authority's incoming high voltage cables; and from which there are satisfactory routes outward for the consumer's high voltage cables. The site, of course, must be near to the consumer's load centre. Having two substations in different parts of the works rather than one larger substation has several advantages. If they are wisely located relative to the load, works distribution losses are reduced. Fewer cables have to be got to and from one point. Fire risk is lessened, and in wartime there is less risk of total destruction. The works 11 kV distribution can be arranged so that the whole works can run if one transformer is lost.

Heavy industry produces a dirt-filled atmosphere, and much of this dirt is of a metallic nature which plays havoc with insulating surfaces. Metalclad, compound-filled switchgear accommodated indoors and transformers with oil or compound-filled cable connecting boxes are well worth while as a precaution against this particular hazard, so that design tends toward indoor substations with no exposed insulating surfaces.

Primary substations usually have two or three 33/11 kV transformers. A two transformer substation provides a secure 15 MVA supply. The addition of a third transformer doubles the secure capacity to 30 MVA, so that, other things being equal, economic considerations favour the three transformer substation. It is convenient to standardize transformer size, and consideration of 33 kV cable ratings makes 15 MVA a convenient size. The transformer can be designed to have a substantial overload capacity when operated with forced cooling, and a skilful combination of feeders and transformers can give a valuable degree of flexibility to meet normal and emergency load conditions. A typical 33/11 kV transformer has a normal rating of 15 MVA and with forced cooling a rating of 18·75 MVA continuously and an emergency rating of 23 MVA for 3 hours. The impedance is 10 per cent at 15 MVA. It is fitted with automatic on-load tap-changing on the 33 kV side giving 15 steps of 1½ per cent each, the tap-changing control gear having line drop compensation and parallel operation facilities. These transformers

are erected out of doors on concrete foundation blocks with oil drainage sumps and with fire barrier walls between transformers if they are close together.

Each transformer can be connected directly to a 33 kV feeder and controlled jointly with the feeder by the circuit breaker at the power station. This is an entirely satisfactory arrangement and requires no 33 kV switchboard in the substation. Where system design considerations make it necessary to bring the feeder on to a 33 kV switchboard each transformer is normally controlled by a circuit breaker. Many ingenious arrangements can be devised to keep the number of circuit breakers to a minimum, and for this purpose the transformer can be controlled by isolators; but these arrangements all impose operational difficulties, and it is doubtful if they are worth while.

If, in the case of a primary substation located on the premises of a large consumer supplied at 33 kV, the 33/11 kV transformers are connected directly to the 33 kV cables, the metering current and voltage transformers have to be located on the 11 kV switchboard. The supply agreement then includes for payment by the consumer of capital and maintenance charges on the transformer and perhaps on some 11 kV switchgear, and for transformer losses.

Potential fault kVA and switchgear rupturing capacity have always provided plenty of problems. A considerable amount of 11 kV switchgear was installed before short-circuit testing enabled rupturing capacities to be accurately determined. Most of this switchgear proved later to be unsuitable and had to be replaced. The need to get into existing substation buildings the same number of circuit breakers as was already there, dictated in many cases the use of 150 MVA gear, which in turn determined the potential fault level.

Where the secondary distribution was fed from a primary substation, the 11 kV fault level could be limited to 150 MVA by feeding through one 15 MVA transformer with an impedance of 10 per cent. Secondary networks fed from power stations required the installation of reactors. In these two ways, an acceptable and reasonably inexpensive solution to a difficult problem was found.

Modern standards demand a degree of security at primary substations which results in transformers being operated in parallel. With two 15 MVA transformers in parallel the fault level can rise to 300 MVA, but is usually kept appreciably below this by feeder impedance; 11 kV switchgear with a rupturing capacity of 250 MVA is, therefore, suitable, and is becoming increasingly the standard switchgear for industrial networks. The fact that it is now made to the same physical dimensions as, and is interchangeable with, 150 MVA gear is of great assistance.

If it is desired to run three 15 MVA transformers in parallel, additional impedance must be provided to retain the 250 MVA limit, either by increasing the impedance of the transformers or inserting separate reactors in the 33 kV feeders. Where 33 kV switchgear is in use at primary substations, 33 kV reactors are often necessary to achieve an economical fault level. A reasonable upper level under present conditions is 750 MVA.

Consumers' switchgear, no less than the supply authority's, must be suitable for the potential fault level, and when development of an electricity supply system makes an increase in fault level unavoidable, it is the consumer's responsibility to make any necessary modifications to his switchgear.

Most industrial consumers have no need for a voltage higher than 415 V 3 phase, and would prefer to take their whole supply at this voltage, and leave the whole business of electricity supply to the supply authority. With supplies of up to say 1,000 kVA this is practicable, but with larger loads difficulties arise. High voltage metering becomes technically more satisfactory, more than one substation becomes necessary, 3·3 and 11 kV motors and a.c./d.c. conversion equipment are in use, and tariff considerations make the metering of the whole supply at one point the preferred arrangement.

Owing to the fact that electricity systems have grown from small beginnings, many arrangements are in existence, and many compromises are operating. Sound practice for a new job, and a reasonable target to work towards in older installations is to supply and meter at one point always, at medium voltage for supplies of up to 1,000 kVA, and at 11 kV for larger supplies. In these latter cases, the consumer carries out his own works distribution at 11 kV. There are some consumers with loads of less than 1,000 kVA, who require to take supply at 11 kV because they have equipment designed for that voltage, or because their works layout needs two or more substations.

Few of the consumers with 11 kV works distributions are equipped to fully maintain them, or to carry out repairs, replacements or extensions. They look to the supply authority to carry out a good deal of this work on their behalf, a service extensively provided. Nor do all such consumers have any comprehensive safety rules of their own in operation on their system. The supply authority can with advantage to both the consumer

Transformer delivery to a typical substation site

and themselves extend their safety rules to cover the consumer's installation, and must insist on this when actually working on the consumer's premises.

Some of the very large consumers may have annual accounts approaching £500,000, and metering of more than usual accuracy is required when a 1 per cent error represents £5,000. Such consumers are usually supplied from one or more 33 kV substations on their works premises, and it is convenient to meter the supply on each incoming feeder, with provision for summation to determine the simultaneous maximum demand. A sound arrangement is to provide duplicate sets of metering, using precision type kWh and kVArh meters, impulse pattern summators and printometer demand indicators.

Opinions vary on the size of consumer for which such metering is justified, but it would not usually be used for consumers with demands of less than 5,000 kVA. For these smaller consumers, demand meters of the trivector or similar type are widely used, with separate kWh meters for unit measurement. The kWh section of the demand meter serves as a check unit meter. Current summation methods of maximum demand metering, using summation current transformers, are used for this size of consumer where there is more than one supply from the same system.

Voltage Regulation

Very difficult problems of voltage regulation are presented by certain types of industrial load, such as electric arc furnaces used for steel making, large rolling mills, colliery winders and butt welders. Outstanding amongst these are arc furnaces. They are usually supplied at 11 kV, and common sizes are in the 3, 5 or 7 MVA range. One recently installed near Sheffield holds 60 tons of steel and takes a load of 15·0 MVA.

The demand created by the furnace is at a maximum at the start of the steel melting cycle, and at this stage varies from no load up to the full output of the furnace transformers, as a result of the melting charge short-circuiting the furnace carbons. This wide variation in load causes a disturbance to supply voltage, which is too rapid to be corrected by the normal on-load tap-changing transformer. It is therefore desirable, and with the larger furnaces absolutely necessary, so to operate the supply system that under normal conditions certain feeders and transformers are reserved for furnace load.

Such segregation of load is not always practicable, and experience shows that arc furnaces not exceeding in size 1 per cent of the short circuit kVA level at the 11 kV busbars can be mixed with other load without much risk of voltage difficulty. Where furnace load is mixed with other types of industrial load, very careful adjustment of the control relay of the on-load tap-changing gear is necessary. Incorrect adjustment will result in very many operations of the tap-changer, which whilst not correcting the very rapid voltage variations caused by the furnace load, will greatly increase wear and tear on the tap-changer. The only reasonably satisfactory solution to the problem of voltage regulation with large arc furnaces is segregation of furnace load to the maximum extent.

Butt welders present a problem which whilst much smaller in magnitude, is not dissimilar in nature to that of the furnace. They occur in sizes up to 500 kVA or more, and the load varies from zero to maximum and back to zero many times an hour. Again, the only reasonable solution is to arrange for one transformer in the works substation to be normally reserved for the butt welder load. The transformer is available for other load in emergency.

Large rolling mills, although a very variable load, do not cause such severe voltage difficulties as arc furnaces, largely because they run continuously, and the momentum of their rotating parts helps to smooth out the load variations. Nevertheless, the largest of them, which may be 7,000 h.p. with working peaks of 14,000 kW, can present some voltage regulation problems.

Colliery winders do not run continuously. They start, stop, and reverse, and can present an awkward problem of voltage regulation if their acceleration is too rapid. A typical size is 4,000 h.p. with peak loads of 8,000 h.p. It is important that the design of motors for these large winders should be carried out with a full knowledge of the capacity and limitations of the systems to which they are to be connected.

These and other problems arising from large and unusual loads met with in a heavy industrial area are evidence of the ever-increasing use of electricity oby industry, and are, therefore, not unwelcome.

Inspection Council to be Set Up

THE Organizing Committee for the National Inspection Council for Electrical Installation Contracting, composed of representatives of the Institution of Electrical Engineers, the British Electricity Authority, the Electricity Boards, the Electrical Contractors' Association, the Electrical Contractors' Association of Scotland, the National Register of Electrical Installation Contractors, and the Electrical Power Engineers' Association and the Electrical Trades Union (representing the Employees' National Committee of the Electricity Supply Industry) announce that the agreement of the sponsoring bodies has now been obtained to the setting up of a National Inspection Council. The objects for which the Council is established are:

(*a*) To set up, issue, publish and maintain a roll for Great Britain and Northern Ireland, the Channel Islands, the Isle of Man and the Republic of Ireland of approved electrical installation contractors who shall have given evidence of their competency by conforming with the rules and regulations of the Council and have undertaken the responsibility required by the conditions of enrolment.

(*b*) To grant and issue certificates whereby the public may be afforded a means of distinguishing electrical installation contractors who shall have given evidence of their competency and to cancel and withdraw these certificates.

(*c*) To inspect electrical installation work in Great Britain and Northern Ireland to determine whether it conforms with the requirements as to workmanship, safety and general standards which may be laid down by the Council.

(*d*) To encourage improved methods of protecting consumers of electricity against faulty or unsafe electrical installations and appliances, and to bring to the notice of the public matters concerned with the safety, standardization, development and improvement of electrical installations.

VACUUM CLEANERS

The next in our series of illustrated surveys of domestic electrical appliances will appear in our issue of 25th February, when we shall be dealing with vacuum cleaners. Information, given in tabular form, will cover details of type, loading, special features, accessories, finish, price and purchase tax. As the demand for these surveys for reference purposes is heavy, orders for additional copies of the *Electrical Review* should be placed without delay. The next survey (18th March) will cover electric floor polishers

Packaged Digital Computers

Ferranti, Ltd., and Powers-Samas Interchange Ideas

COLLABORATION between the executives and engineers of the Computer Department of Ferranti, Ltd., and Powers-Samas Accounting Machines, Ltd., is taking the form of a complete interchange of ideas to avoid any duplication or overlapping in the solution of their research, development and production problems. The results of this mutual stimulus are expected to be increasingly beneficial to both companies in the fields of electronic calculation and data processing.

Ferranti, Ltd., is the first British manufacturer of large-scale electronic digital computers and was the first to offer, in 1951, a commercially available computer in this country. This was known as the Manchester machine (Mark I) and was based on an experimental model built by Professor F. W. Williams and Dr. T. Kilburn and their colleagues in the Electrical Engineering Department of the University of Manchester. Later development work was incorporated in electronic computers now in use at the universities of Manchester and Toronto, the Ministry of Supply, the Shell-Mex laboratory, Amsterdam, Rome and an aircraft works. Each of them, employing 4,000 valves and costing £80,000 to £85,000, has taken about twelve months to complete from the start to installation and the final performance tests. The Ferranti electronics branch assembly section is now housed on the ground floor of a disused mill at Chadderton. It occupies a floor area of 12,000 sq ft and is just an early stage in a development plan which will take about five years to complete.

The "Pegasus" Machine

Recently, Ferranti have introduced a new medium-sized computer, known as the "Pegasus" (cost about £35,000); it is a general purpose machine suitable for a wide variety of calculations of the type and magnitude which arise in industry, research and management. To prepare a calculation or problem for the machine, the requirements must be precisely stated. A programme is then prepared translating them in terms of the facilities of the machine and the various operations which it can perform. The programme is quite general in the sense that the instructions will apply to any data which may be given to the machine for the particular type of problem. When the programme has been prepared and coded, the information is punched on to teleprinter paper tape and "read" into the machine by photo-electric cells. The different arrangement of holes on the tape conveys the appropriate information to the computer. When a calculation has been completed, the results are presented by being punched on to paper tape which passes on to actuate an automatic typewriter. The "Pegasus" packaged computer is built up from a range of standardized plug-in units, so that maintenance can be quickly carried out by replacement.

The Powers-Samas company envisages the production of a smaller type of machine, expected to come off the production lines early in 1956 and likely to cost £15,000 to £16,000. It was recently stated that the "Pegasus" packaged computer would be in production before the end of this year, so that both this and the Powers-Samas machine —which had different functions—would be in production at the same time. The Powers-Samas machine would be able to do complete pay roll calculations, from gross pay to net pay at the rate of 120 cards a minute. It could also be used for all sorts of ledger work and for any other types of work normally encountered in industry where calculations were involved.

Collaboration between Ferranti, Ltd., and Powers-Samas would concentrate on the data processing equipment, bringing together the wide and varying mechanical techniques of Powers-Samas and the electronic techniques of Ferranti, Ltd., and establishing a common objective in data processing at high speed. Both companies would be making particular products which would be part of their respective systems. The small Powers-Samas machines were claimed to be in advance of anything used in the U.S.A.

Much commercial research work had been done to establish what the market wants in the way of computers and data processing equipment, and it was hoped to develop a range of machines that could be linked together in a variety of ways to form unit blocks suited to the requirements of the customer.

Power Station Chimney Emissions

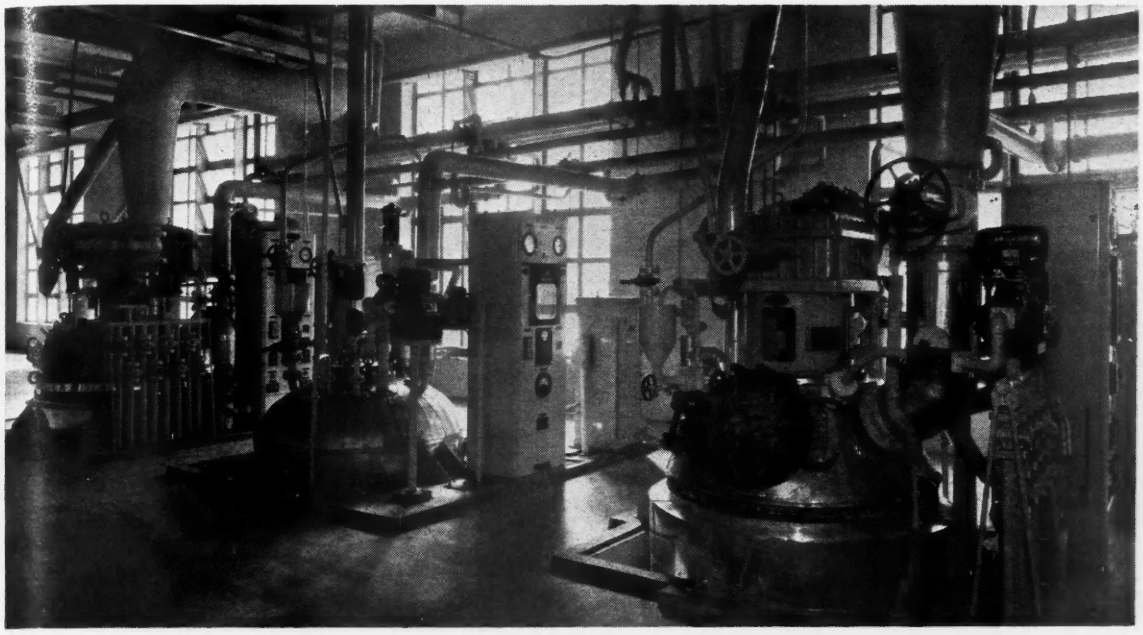
RESULTS of experiments in a wind tunnel to determine the effects of velocity and temperature of discharge on the shape of smoke plumes from chimneys were given by Messrs. L. W. Bryant and C. F. Cowdrey (National Physical Laboratory) at a meeting of the Institution of Mechanical Engineers on 11th February. The authors discussed with the aid of worked out examples the effects of chimney height and diameter and of washing the effluent, as against discharging hot gas, in relation to the concentration of sulphur dioxide at ground level.

They showed that the loss of buoyancy due to washing destroyed the advantage of reduction of SO_2 at the exit when air turbulence was less than that corresponding to wind speeds of about 15 m.p.h. Advantages of washing increased with wind speed and turbulence. Speeds of above 20 m.p.h. occurred in built-up areas in Britain usually on fewer than one day in sixty.

With a given volume rate of discharge the maximum concentration of SO_2 was greater for the washed than unwashed gases when the diameter of a stack over 100ft tall exceeded 30ft. For a stack of 200ft and over the greatest concentration of SO_2 anywhere on the ground would not exceed one-thousandth of that present at the exit if the effluent were unwashed and if the wind speed were not much above 20 m.p.h.

Maximum concentration occurred much nearer the stack with washing. It decreased with height of stack and occurred farther from it. Beyond the first quarter of a mile, concentration was much greater with unwashed smoke. When washing is employed the exit velocity should be kept as high as possible by reducing the diameter in nozzle fashion at the top of the stack.

Concentrations at a level comparable with a chimney height of 50ft would be notably greater than those on the ground and would be little altered by variation of stack height. Washing would then be advisable unless the site affected were more than a mile from the stack. For a power station in a built-up area with buildings of very uneven height or in a hilly countryside, it was suggested that a model test was invaluable in determining the course of the smoke plumes as influenced by the contours of the surroundings.



Oil and Grease Production

New Plant at Birkenhead

THE newly reconstructed grease works of the Vacuum Oil Company at Birkenhead is one of the largest in Europe; it can dispatch 1,500/2,000 tons of lubricating oils a week and a high tonnage of greases in two hundred different grades. Preparation for the new plant began in July, 1951, and full production was achieved by June last year.

The factory electrical system consists of two 500 kVA transformers taking a supply from the grid at 6,600 V. Both of these transformers can be paralleled to the grease plant as necessary. On the output side of the transformer the m.v. supply to the grease plant is taken at 415 V. Power and lighting supplies are split at the main substation and taken to the grease plant switchroom by armoured cable.

The power demand is principally for the four contactor kettles and the eight grease kettles. On the former there are squirrel cage induction motors of 30 h.p. and 60 h.p. driving impellers and mounted on the bottom of the contactors which protrude through the first floor. They are controlled by Brookhirst direct-on-line contactor type starters mounted on the first floor adjacent to each contactor and are fitted with an isolating switch which can be padlocked in the open position for maintenance purposes. The starters themselves are push-button operated from the instrument panel local to each starter. A "motor running" light is provided for each contactor on the main instrument console and an emergency stop button is mounted on the ground floor in the vicinity of each impeller motor.

The grease kettles are driven by three-speed squirrel cage induction motors of 20 to 75 h.p. controlled by direct-on-line contactor type starters mounted adjacent to each kettle. These are push-button operated from the instrument panel local to each starter. Each instrument panel has push-button controls for the kettle agitator, exhaust fans and lubricating motors, together with the agitator motor ammeter and "motor running" indicator lights. A "motor running" indicator light is also provided for each kettle on the main instrument console. The lubricating motor starter is electrically interlocked with the main agitator motor starter in such a way that the main starter cannot be operated until the lubricator starter has been closed. The motor starter will remain closed, however, should the lubricator starter open for any reason, after the initial start. A red warning label on the panel instructs the operator to check the lubricating oil flow before closing the agitator starter.

The general lighting throughout the main building is provided by 5ft 80 W twin tube fluorescent fittings chain suspended from the roof purlins, and the lighting switches are arranged in gang form at convenient positions. The lighting fittings are mounted in lines running through the length of the building and are generally controlled in banks of four from one switch. The street lighting is provided by 60 W sodium bracket lanterns mounted on the external walls of the main building. General lighting in the tank farm and tube still area is provided by pendant and pole mounted 150 W tungsten weatherproof fittings.

Strip heaters are used for conservation of heat in weigh tanks. Infra-red heating is used for pre-melting fat stocks. All pumps in the plant are electrically driven.

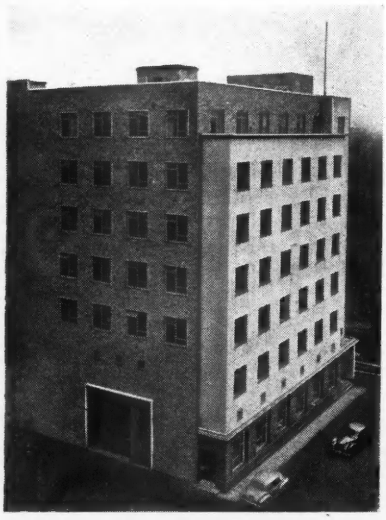
The title photograph shows two grease kettles with a heating contactor between them

Electron Microscopy in Oil Inspection

THE conclusions drawn by Dr. F. T. Barwell and Messrs. L. Grunberg and D. Scott (Mechanical Engineering Research Laboratory) from an investigation of heavy-duty lubricating oil by electron microscopy are unfavourable to the use of this method. In a paper published by the Institution of Mechanical Engineers, the authors give reasons for believing that the electron microscope is unlikely to provide a very useful means of examining unused h.d. oils and express doubts regarding the validity of an explanation of successful use based solely on deflocculating or dispersant action.

Fuel for the City

HISTORIC ASSOCIATIONS OF NEW SUBSTATION SERVING THE CITY OF LONDON



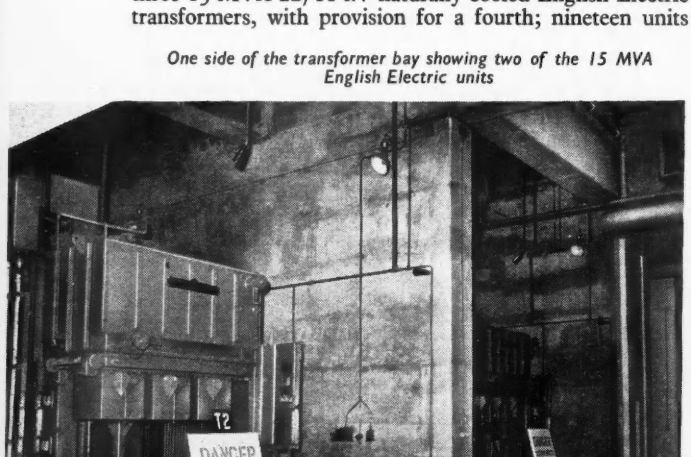
Seacoal House, the new office and substation of the London Electricity Board

THE Lord Mayor of London, Alderman Sir Seymour Howard, last Friday inaugurated the new Seacoal Lane substation of the London Electricity Board. In a short address to a gathering of about 200, which included representatives of many of the great institutions of the City as well as employees of the London Electricity Board and the contractors concerned, he recalled that after the great fire of London, Wren's plans for rebuilding included a wood yard on this spot, as a fuel supply for the citizens.

Mr. H. J. Randall, chairman of the London Electricity Board, in welcoming the Lord Mayor, had explained that when coal first came into use for heating in London, it was landed in the old Fleet river and brought into the City via Seacoal Lane. Now power for heating and other purposes came to the same point, but as electricity. The London Electricity Board was proud to preserve this association with the past.

The new substation, serving the western half of the City, replaces an existing one built by the Charing Cross Electricity Supply Company beneath an arch of the Southern Railway. The equipment installed consists of three 15 MVA 22/11 kV naturally cooled English Electric transformers, with provision for a fourth; nineteen units

One side of the transformer bay showing two of the 15 MVA English Electric units



Reyrolle22 kV metalclad switchgear

of 22 kV 500 MVA indoor switchgear by A. Reyrolle & Co.; and twenty-two units of 11 kV 250 MVA gear by the same makers. The switchgear is all housed below ground level. The transformers occupy a depth of two floors at the rear of the building and there is a control room on the second floor; the large access doors to the transformer bay can be seen in the accompanying view of the building. Supply is obtained at 22 kV from Deptford and Bankside power stations and indirectly from Battersea.

The control room also supervises the operation of the space heating installation which, appropriately, is all-electric. The building is heated by floor and ceiling panels containing embedded coils of mild steel tubing. These are supplied from two 3,000 gal hot water storage tanks in the basement, heated by a 450 kW electrode boiler made by G.W.B. Electric Furnaces, Ltd., and run only at off-peak periods.

The offices above the substation are to be used for the Sub-Area accountancy staff and the building itself is part of a block to be developed by the City Corporation, from Ludgate to Fleet Lane, forming the north-east corner of a new Ludgate Square.

Material Testing Conference

AN international conference on the non-destructive testing of materials will be held in Brussels from 23rd to 28th May next, under the auspices of the l'Association des Industriels de Belgique in co-operation with European and American technical organizations and under the chairmanship of Professor Georges-A. Homès (Faculté Polytechnique de Mons et Université Libre de Bruxelles).

The aim of the conference is to discuss the present state of the non-destructive testing methods from the standpoint of scientific research, industrial application, and education. It will also deal with the international aspects of co-operation as to exchange of information, thereby contributing to improved economy, design, application, and safety of non-destructive testing.

Vision in Relation to Illumination

Work at the London School of Hygiene and Tropical Medicine

By T. C. ANGUS, D.Sc., A.M.I.E.E., F.I.E.S.*

IT may be taken as one of the signs of the times that the medical profession is becoming more and more interested in the requirements of the normal healthy individual for the maintaining of day-to-day fitness, comfort and working capacity.

Doctors intending to make their careers in public health, as medical officers in industry, or as specialists in charge of the welfare of personnel in the Services are required to take post-graduate courses in many subjects. Thus, to obtain the Diploma of Public Health students must show that they possess an adequate knowledge of applied physiology, which is particularly concerned with the study of the living and working environments of men and women in relation to the requirements of the human body as a whole and of the special senses of hearing and vision. Hence, in the course provided at the London School of Hygiene and Tropical Medicine it has long been the practice to draw attention to the links between the physiology of vision and the provisions which should be made by the illuminating engineer and architects and management if the needs of the human eye are to be met in the factory or in the home.

The Doctor's Concern

At first sight it may appear unusual that medical men should be expected to have an opinion as to the lighting of a dwelling, school, office or factory, decisions in this direction being generally referred to the architect, works manager or the maintenance engineer; but on consideration the connection is reasonable enough. Lighting, for whatever purpose, by whatever means, and in whatever locality has but one purpose—namely to provide conditions which permit certain responses in the retina of the human eye to take place. From this premise it follows that the immediate effects are physiological and psychological, and so within the province of the medical man.

The lecturers' approach to the subject of vision, lighting and illumination in the Department of Applied Physiology, London School of Hygiene and Tropical Medicine, is to make the student aware of the wide variety of visual tasks to be found in the factory and in the home, and also with street lighting. While no attempt is made to train the doctor in the technicalities necessary to enable him to prescribe or design lighting installations the aim is to make him observant, and above all critical. He should be ready to suspect and be able to detect inadequate or bad lighting installations and, if not able to prescribe suitable remedies himself, to know in what directions the remedies are likely to lie and whom to approach for a solution of his difficulties.

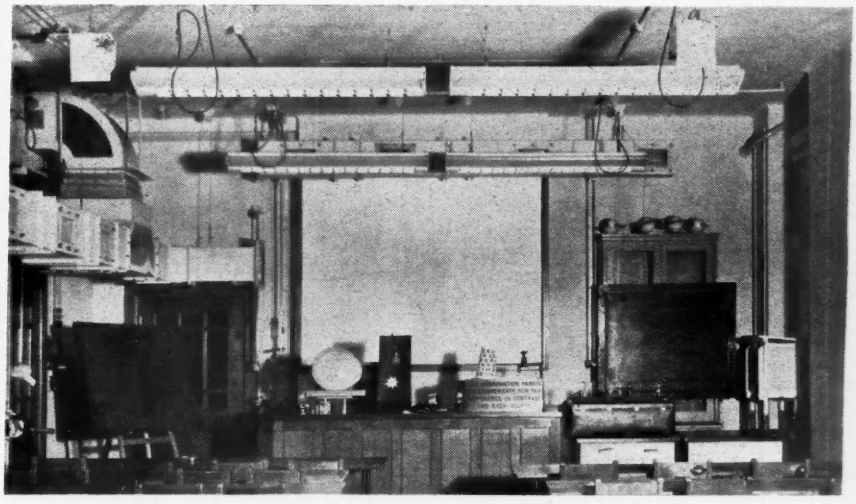
We believe that of recent years this presentation has been justified, as witness the numerous inquiries as well as complaints which we have received from old students who have gone into industry or elsewhere and have found that all has not been well with the lighting installations in use.

In all but the earliest stages of his training the doctor regards the eye as the site of various diseases and traumata, and learns the appropriate treatments to ease the distress of his patients. Now he is invited to regard the eye as a television camera requiring certain conditions in order to operate satisfactorily, and he is shown what but few of us recognize, how vitally the efficient functioning of the eye is bound up with the contentment and efficiency of the man when working. The need for restful and agreeable lighting in the home, to counteract the effects of the bright and stimulating lights needed for work, is pointed out: the basis of the whole course of applied physiology is the necessity of defining conditions which enable a balance to be maintained in the daily sequence of work-fatigue-recovery. It is also shown that with the present-day lamps giving outputs of light hitherto almost unheard of there is a real risk of misuse and misdirection of light when lamps are unsuitably placed or improperly shaded. This was non-existent when the domestic table lamp had the Argand burner and gave the soft mellow light of the paraffin flame instead of the uncompromising glare of a bare metal filament lamp.

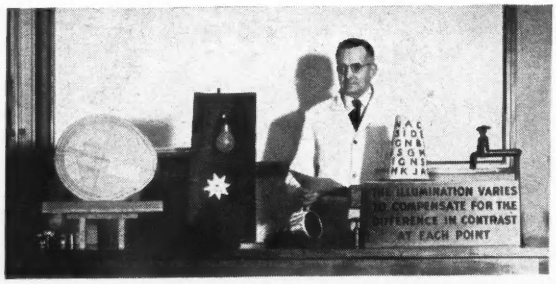
Direction and Scope of Studies

It may be of interest to take a rapid review of the short course on the science and art of vision and illumination

* Senior Lecturer, Department of Applied Physiology, London School of Hygiene and Tropical Medicine.



A general view of the lighting and ventilation laboratory



Models demonstrating the effects of glare on the retina and the need of good lighting to see moving objects and objects with poor contrasts

now being given at the London School of Hygiene and Tropical Medicine. Those studying for the Diploma of Public Health are introduced to studies which are coming to be known under the name of hygiene engineering, and this is a link between the practitioners of preventive medicine and engineers, chemists and physicists. The subjects in this category include, besides those dealing with sight and illumination, the warming and ventilation of factories and dwellings, the estimation and control of toxic hazards such as airborne dusts and fumes, weight-lifting and accident prevention and the physiological effects of high and of low air pressures and temperatures.

The teaching in vision and illumination takes the form of lectures with demonstrations, tutorials, and visits. In the first lecture students are presented with the idea that the human eye underwent a very slow evolution through millions of years into a perfect organ for the primitive hunter who, if he had any artificial light at all, obtained it from the fire in his cave. But in terms of biological time the cave-man lived " only yesterday." So far as we know it was no longer than 10 or 20 thousand years ago that man came " indoors " and perhaps for the first time started to perform close range (mesoramic and ancoramic) visual tasks for considerable periods. After the industrial revolution the proportion of time given over to close work by artificial light greatly increased, but authorities tell us that the structure of the eyes with which we are born is no different from that of the eyes of the cave-man's baby of 20,000 years ago. So we may say that to use the eyes continuously for close work and by artificial light (as we all have to do now) is something of a physiological abuse and that anything that we are able to do in order to facilitate seeing, when at work or in the home, is amply justified.

The student is then shown the remarkable drop in the cost of electric lighting, expressed in lumens per watt, that has been brought about by the improvement of light sources during recent years, and in spite of the rise in cost of almost everything else, the point of emphasis being that there is now no excuse whatever for inadequate lighting, but rather a risk that if thoughtlessly applied the much more powerful light sources of to-day may do more harm than good.

Students are reminded of the structure of the inner eye and the relative sensitivities of different parts of the retina (after Wright). They are given a very short historical sketch of the development of windows in dwellings, an introduction to the sky factor measurement of natural illumination; of the developments of lamps, from candles and " dips " to fluorescent tubes; and reference to the work of H. C. Weston, H. L. Logan and others indicates the larger outlook now being recognized—the importance of considering the relationships between the brightnesses of all parts of the visual field rather than only the illumination of the object to be examined and its near surroundings.

The importance of evaluating visual task is emphasized and six cardinal points for vision are given as:—(Positive) sufficient light to stimulate the retina; image on retina sufficiently large; sufficient contrast between different parts of the image. (Negative) Insufficient light; objects too small; glare. Demonstrations are given with models to show how necessary it is to have more light when the objects to be observed are moving (machinery), and that the difficulty of visual discrimination of objects presenting poor contrasts can be overcome to a certain extent by providing more light. Also the effect of glare in rendering the object to be seen invisible in an extreme instance. Here I should like to acknowledge our gratitude to Mr. E. B. Sawyer, of the Lighting Service Bureau of the Electric Lamp Manufacturers' Association, and his colleagues, for much help and advice in presenting these demonstrations.

One important lesson is that middle-aged and old people and also the many persons with slight visual defects, need more light than young persons with clear optic media and no errors of refraction. We are told that less than 2 per cent of the population have perfect sight, so the " normal " vision of the population is slightly imperfect. It follows that, as a convoy can be no faster than its slowest ship, so if the whole of an industry's workers are to keep the pace of production the lighting supplied should be adequate for those of their number with slight visual imperfections. Students are then introduced to the recognized codes of practice for lighting, particularly that of the Illuminating Engineering Society.

Practical Exercises

The next lesson is in the use and the limitations of portable photometers of the rectifier type. In tutorials the students make a light survey of the special laboratory and lecture room which is equipped for the study of lighting and ventilation.

This laboratory, 40ft by 22ft, has recently been re-equipped, and is lit by eight louvred and plastic shaded fittings each containing two 80 W warm-white fluorescent tubes. The intensity of illumination on the working plane is about 20 lumens/sq ft. The four fittings nearest to the lecturer are hung on wires from small winches by which they may be raised and lowered at will. These four fittings are specially constructed so that the louvres and plastic shades may be removed and the bare lamps exposed not far above eye-level.

The object lesson intended is to show how *not* to install powerful lamps. The students come in and take their places with some of these lamps at low level and fully exposed. After a few minutes of lecturing, during which time the students have been trying to follow the lecturer, the glaring lamps are switched off or shaded, and an immediate relief is experienced. This demonstrates in no uncertain manner how easily we can adapt our senses to disregard discomforts, even when unconscious of them, and how real is the relief when such unrecognized discomforts are removed.

Later in the course students visit the Lighting Service Bureau and the Safety, Health and Welfare Museum of the Ministry of Labour and National Service. At both of these establishments they have the opportunity to learn of the most recent developments in lighting practice and of the results of recent relevant researches. A lecture on present-day conceptions of eye strain by an acknowledged authority concludes a course which, although admittedly incomplete, is believed to incorporate much that is likely to be of immediate value to doctors who may be called upon to express opinions and give decisions on lighting problems.

In addition to our indebtedness to E.L.M.A. I should like to express our thanks to the British Thomson-Houston Co., Ltd., for advice and material assistance.

WORLD ELECTRICAL MARKETS

*Prospects in the United States**

THE degree of electrification in the United States is greater than in any other country. By the end of 1953 98 per cent of the American population of 160 million were consumers of electricity provided by private, co-operative and public power plants. Further growth took place last year, and generation of electricity aggregated about 525,000 million kWh, 2 per cent more than in 1953 when the recession was making its effect felt most sharply.

Since 1945, no fewer than 16 million customers have been added and this has naturally called for a heavy increase in generating equipment. While expansion was hampered to some extent by various controls, the final removal of restrictions in 1953 led to the installation of 9,200 MW in 1953, and this figure seems to have been exceeded last year, when the amount invested in new plant reached $3,000 million. Last year's programme of expansion carried the industry's installed capacity beyond 100,000 MW—well over double the capacity at the beginning of 1945.

The privately owned section of the industry accounts for 80 per cent of all electricity generated, and its capital assets total some $28,000 million. Since power was first provided in 1882 the cost to the consumer has fallen from 24 cents per kWh to 2·75 cents in 1953. However, the post-war inflation of costs has very largely counteracted continuing economies in production, and the downward movement of prices appears to have been halted. Nevertheless, consumption by the average householder continues to expand: 1953 showed a gain of 186 kWh per customer, and a similar increase in 1954 has carried average consumption over the 2,500 kWh mark.

By the end of 1954 the United States, with 7 per cent of the world's population, generated just over 42 per cent of the world's electricity (the Soviet Union's share is about 10·6 per cent). There is now a margin of generating capacity over demand of about 17 per cent, compared with one of only 10 per cent in 1950.

In spite of this rapid and enormous growth, further expansion at the same rate is envisaged for 1955 and succeeding years, and it is important to note that the growth in domestic demand is so strong as to be able to counteract the effects of anything but a prolonged and serious industrial recession: sales of electric cookers, water heaters, air conditioners, laundry dryers, roasters, radio and television sets, food mixers, refrigerators, electric blankets and all the host of other apparatus which are a feature of the American way of life, ensure a continuous increase in electricity in the American home.

All this means the harnessing of more and more power, and construction schemes are going ahead in virtually every state and large city in the Union. That the resources are there to be tapped can be seen from the fact that so far only 20 per cent of America's hydro-electric potential has been harnessed. Detailed plans exist for the building of hydro-electric plants, particularly in the Western mountain States and the Missouri Valley. However, the extent of progress actually made will depend on the relationship between public and private power interests which develops over the next year or so.

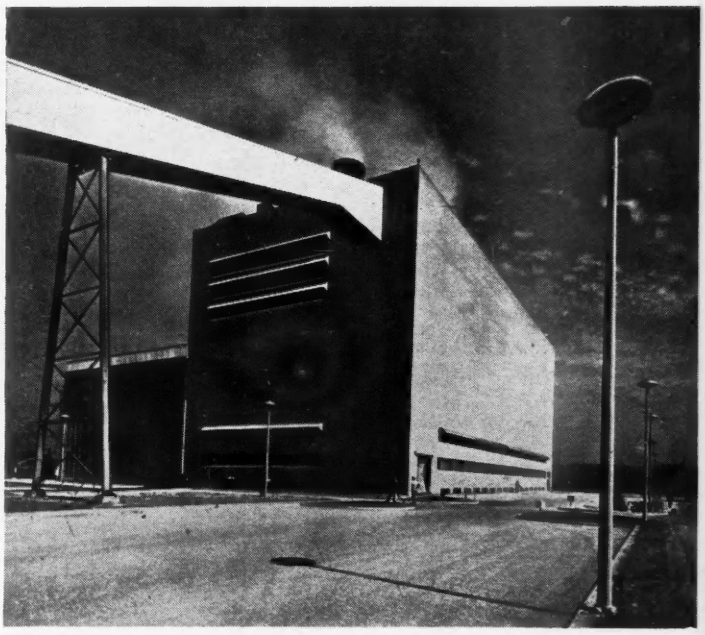
The Republican Party has a reputation of hostility towards public power projects, and many of its prominent members regard the Tennessee Valley Authority itself as undesirable "creeping socialism." Some months ago it seemed that the President might share these views, but since the Democratic victory in the Congressional elections he has apparently modified his views, saying that it is the function of the Federal Government to help the people to do things which they could not do unaided. This seems to improve the prospects for public power projects.

In most cases such as the well-known Hell's Canyon, competing plans exist, with the Federal scheme planned to provide larger dams and more power at greater initial cost but lower eventual rates than those put forward by private companies. This clash was a major election issue last November in many States, and may even have clinched the Democratic victory in Oregon which gave the party control of the Senate. Among the major schemes are Reichle and Clark Canyon in Montana, Echo Park in Colorado, Glendo in Wyoming, Blunt and Big Bend in South Dakota, and Turtle Lake in North Dakota. Work is already going ahead on fourteen dams in these States, notably on the Platte River in Wyoming and the upper reaches of the Missouri in Montana.

Nebraska also faces the need for further power if it is not to be under-supplied in 1957. In the past, most of the dams in the Missouri Basin have been regarded as multi-purpose, with irrigation and flood-control seeming more important than the generation of power, but electricity is becoming of greater interest to the area's inhabitants.

Further west again, several other hydro-electric projects are under way, notably the Priest Rapids scheme in

A modern steam plant operated by the Tennessee Valley Authority. The conveyor carries coal, therefore hooded slits substitute for windows where the building is exposed to dust



* Contributed by the *Economist* Intelligence Unit.

Washington, where installed capacity will eventually be 1,200 MW. Other construction is taking place at Bruce's Eddy to produce 244 MW in Idaho and the Dalles and McNary Dams on the Snake River in Oregon, though in some cases the division of finance between private, State and Federal purses has not yet been completely clarified.

Partnerships between the interests are proposed for the Cougar Dam in Oregon, rated at 37·5 MW, with Federal funds meeting three-quarters of the cost. A similar plan has been put forward for the Green Peter Dam in the same area, costing $85 million. Total investment needed by 1961 in the area is put at $7,000 million: in the last twenty years expenditure has been $1,800 million, of which the Federal Government put up five-sixths.

In spite of this immense expenditure, the contribution which hydro-electricity can make to America's power supplies is limited by the fact that well over half of the potential is west of the Rockies, in areas with populations well below half of the total. At present water power accounts for only 20 per cent of all power generated, and the proportion cannot be expected to rise very much in future. East of the Rockies other types of plant will have to be used, and it is probable that a rate of expansion will prevail similar to that further west. Most urban areas are planning further additions to capacity. Among industrial centres Detroit, Ohio, Pittsburgh, Milwaukee and St. Louis all have continuing programmes of expansion and so have wider areas such as New York State, New Jersey and Texas.

Import Trade

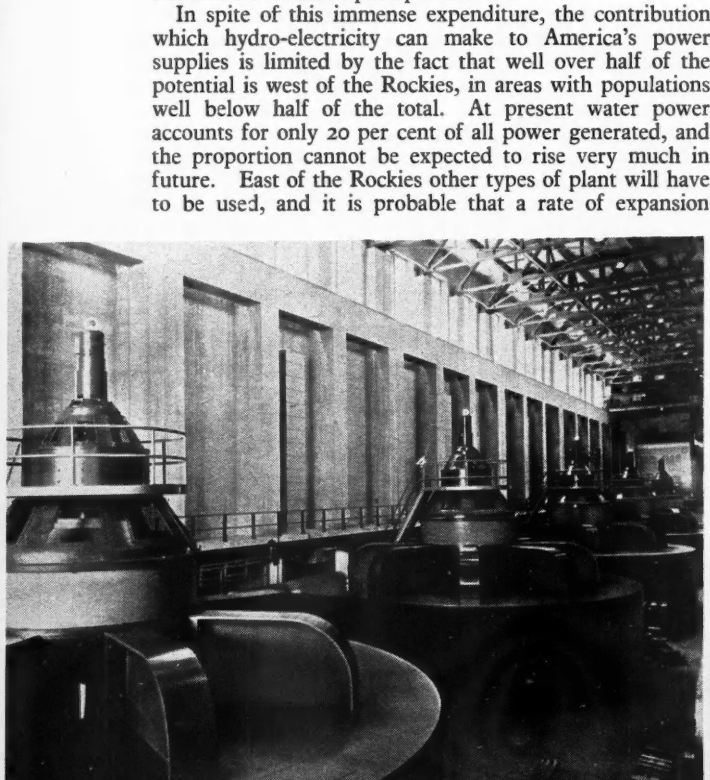
With demand and supply both soaring, America's imports of electrical goods and equipment seem very small, amounting to only some $36 million in 1953 and a probable $42 million last year. The largest imports are of converting and generating equipment, transformers and switchgear, radio equipment and telephone apparatus and electric motors, while there is a considerable business in fancy lamp bulbs, mainly bought from Japan.

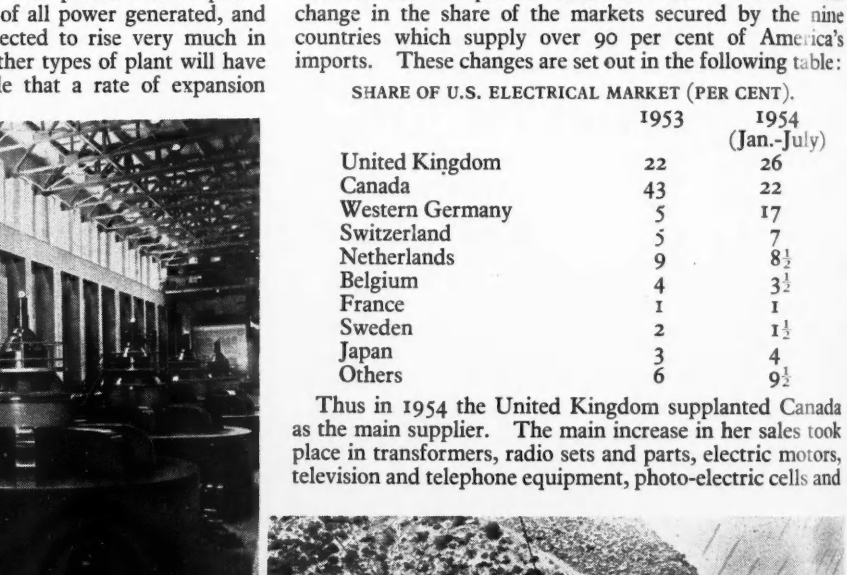
The accompanying chart analyses in detail American imports in 1953 and the first seven months of last year. Between the two periods there has been a considerable change in the share of the markets secured by the nine countries which supply over 90 per cent of America's imports. These changes are set out in the following table:

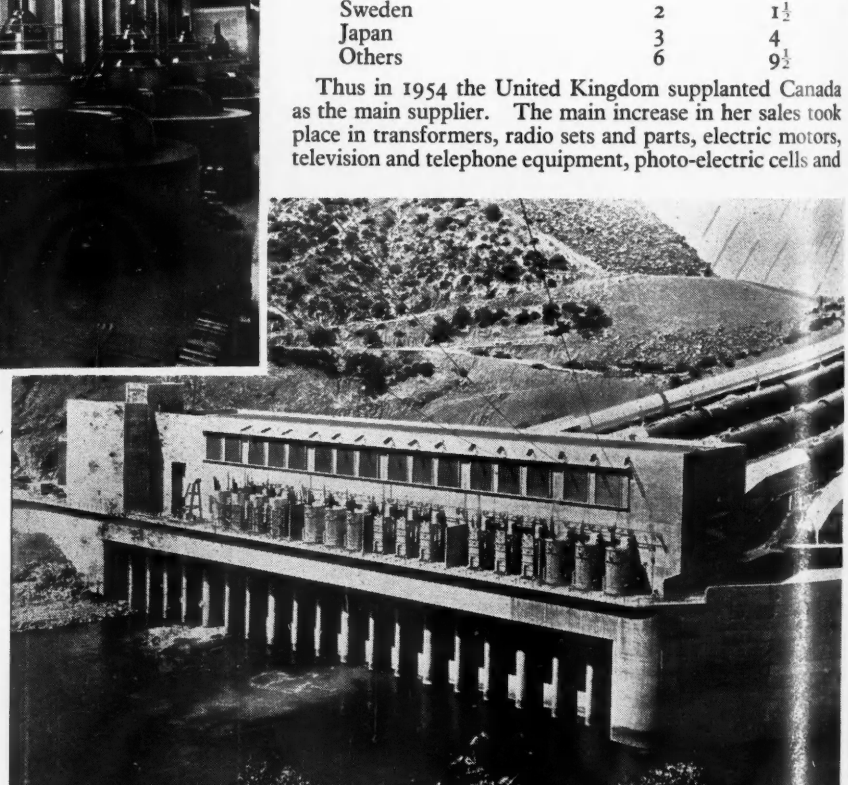
SHARE OF U.S. ELECTRICAL MARKET (PER CENT).

	1953	1954 (Jan.-July)
United Kingdom	22	26
Canada	43	22
Western Germany	5	17
Switzerland	5	7
Netherlands	9	8½
Belgium	4	3½
France	1	1
Sweden	2	1½
Japan	3	4
Others	6	9½

Thus in 1954 the United Kingdom supplanted Canada as the main supplier. The main increase in her sales took place in transformers, radio sets and parts, electric motors, television and telephone equipment, photo-electric cells and







Exterior and interior views of the Shasta Dam power plant. Above are shown four of the five 75,000 kW generators now in operation while in the picture on the right can be seen the water conduits and (top right) part of the wall of the 602ft high power, irrigation and flood control structure

UNITED STATES IMPORTS OF ELECTRICAL EQUIPMENT AND PRINCIPAL SUPPLYING COUNTRIES

Class	1953 ($000)										1954: January-July ($000)									
	United Kingdom	Others	Canada	W. Germany	Sweden	Switzerland	Belgium	Netherlands	France	Japan	United Kingdom	Others	Canada	W. Germany	Sweden	Switzerland	Belgium	Netherlands	France	Japan
Electric lamps	11	908	—	13	—	—	13	—	—	826	—	868*	—	—	—	—	—	—	—	710
Vacuum cleaners	43	17	—	16	—	—	—	—	—	—	19	21*	—	—	—	—	—	—	—	—
Generators	6	340	309	8	—	—	—	—	17	—	28	329*	90	—	—	158	—	—	—	—
Convertors and generators	267	7,446	6,854	112	—	333	—	—	—	—	—	89*	—	—	—	71	—	—	—	—
Transformers	202	831	52	19	—	562	—	—	—	—	425	366	—	101	—	223	—	—	—	—
Switches, fuses	92	924	87	—	40	590	—	—	131	—	—	857*	—	—	—	671	—	—	78	—
Other control apparatus	Not separately available.										195	2,060	1,680	—	—	213	—	—	—	—
Sockets, etc.	40	66	29	13	—	—	—	—	—	—	—	54*	12	—	—	—	—	—	—	—
Electric motors (stationary, rly.)	839	892	360	—	—	—	353	86	—	—	822	672	288	—	—	—	306	—	—	—
Fans, blowers	20	61	12	7	—	36	—	—	—	—	—	37*	10	—	—	—	—	—	—	—
Electric motors (parts)	226	158	108	—	—	—	—	—	—	—	67	111	81	—	—	—	—	—	—	—
Flatirons	20	16	—	16	—	—	—	—	—	—	—	7*	—	—	—	—	—	—	—	—
Other domestic utensils	5	50	—	—	33	—	—	—	—	—	—	7*	—	—	—	—	—	—	—	—
Therapeutic apparatus	42	446	361	40	—	—	—	—	—	—	—	189*	12	—	—	—	—	—	—	—
Radio sets, parts	351	2,857	1,920	109	—	123	—	620	—	—	310	964	429	200	—	51	—	225	—	—
Television apparatus	112	15	—	—	—	—	—	—	—	—	254	65	—	15	—	—	—	—	—	—
Telegraph apparatus	51	396	368	—	—	—	—	—	—	—	—	53*	—	—	—	—	—	—	—	—
Telephone apparatus	94	2,451	2,035	45	—	—	325	—	—	—	155	1,129*	420	117	—	—	496	—	—	—
X-ray tubes	1	113	—	—	—	—	—	99	—	—	—	56*	—	—	—	—	—	—	—	—
X-ray apparatus	32	488	—	171	82	—	—	174	—	—	—	417*	—	127	65	—	—	105	—	—
Photo-cells and electronic tubes	78	227	—	—	—	—	—	178	—	—	65	155	—	—	—	—	—	125	—	—
Batteries	29	157	—	—	125	—	—	—	—	—	24	194	—	—	30	—	—	—	—	—
Stoves	2	22	11	—	—	—	—	—	—	—	—	4*	—	—	—	—	—	—	—	—
Furnaces and heaters, etc.	97	187	104	39	30	—	—	—	—	—	—	84*	36	11	—	—	—	—	—	—
Washing machines	587	26	—	—	—	—	—	—	—	—	238	6	—	—	—	—	—	—	—	—
Other machines	125	177	—	88	—	34	—	—	—	—	10	99*	—	57	—	—	—	—	—	—
Other items	4,303	9,194	3,250	1,168	402	777	623	2,294	247	170	3,803	9,162	2,362	3,452	274	568	146	1,623	85	81
Totals †	7,693	28,465	15,860	1,874	720	1,865	1,314	3,431	395	996	6,415	17,856	5,520	4,080	369	1,955	948	2,078	163	791

* Owing to insufficient breakdown of monthly imports, these figures may include additional sales by the United Kingdom.
† For the same reasons, totals shown against each country may slightly under-estimate actual imports.

batteries. On the other hand, a promising trade in washing machines, worth nearly $600,000 in 1953, has dried up completely since April, 1954, after reaching even higher levels in the first quarter of the year.

Great Britain enjoys a dominant position in sales of television equipment and has about half the market for transformers and electric motors. But competition is keen, particularly from Western Germany, which in the first half of 1954 sold three times as much equipment as in the whole of 1953, and more than trebled her share of the market. German sales have risen most for radio sets, telephone equipment, X-ray apparatus and transformers, while she is also beginning to build up her exports of television equipment—a list which has particularly menacing overtones for this country.

The decrease last year in Canadian sales is mainly attributable to a heavy fall in American purchases of radio and telephone apparatus, the brunt of which has fallen on Canadian suppliers, but Canada remains an important competitor in many other fields.

With a further gain in production probable in 1955, America should offer a good market for electrical goods this year. One big question mark is of course tariff policy, but on the whole the outlook is more favourable than at any time for many years. American tariff policy will almost certainly be much more liberal for two reasons. First, renewed economic expansion will lessen fear of foreign competition and, secondly, a Democratic Congress should prove a more loyal supporter of the Administration's comparatively liberal foreign trade policy.

Another important consideration is the recent revision of the so-called "Buy American Act." Formerly this allowed official contractors to refuse foreign tenders if they were less than 25 per cent below the best American offer—and there were also many loopholes which led to bids being rejected even when they were cheaper than this. Now the Act has narrowed the limits to 6 to 10 per cent, and, more important, makes it necessary for foreign bids to be accepted if they have this margin, except in specified situations which might prejudice the country's security or directly cause unemployment. Of course much will turn on how the Act is construed but it seems that it will receive liberal interpretation this year and next, which should offer a good market to foreign manufacturers, particularly for heavy generating equipment, where the content of skilled labour is very high and high American wages prove a competitive disadvantage.

Foreign equipment, particularly British, has a good name in the United States and suppliers should see a good demand if deliveries are competitive. The magazine *U.S. News and World Report* recently reproduced a picture of a 230 kV transformer from Great Britain being unloaded, and ran the caption "Made in Britain—a label to contend with" beneath it.

But British manufacturers will have to be energetic to retain a quarter of the American import market in face of growing German competition. In many cases more imaginative selling methods are needed, and those who take the trouble to study the variations in household appliances—most American electricity supplies are low voltage—will find a ready market for competitive goods suitably modified.

More and more firms are finding that the American market cannot be effectively tackled from England. German companies are appointing distributing and advertising agents in America, people who know the market and whose advice they follow unquestioningly. Our own exporters have not been so quick off the mark—many are probably not even aware of the arrangements by which an advertising campaign in America can be underwritten by the Board of Trade.

This should be a year of good sales to America without any special efforts. But that makes it a particularly favourable time to make the special effort to expand and consolidate sales to a level capable of withstanding future fluctuations. An investment in market investigation in the United States this year should yield extraordinarily good dividends in future years, if we have the foresight to make the effort instead of just lying back to enjoy good luck while it lasts.

Long-Distance Radio Communications

Operating Conditions Discussed

THE discussion on two papers on the " Performance of H.F. Radio-Telegraph Circuits " and " A Study of Commercial Time Lost on Transatlantic Radio Circuits due to Disturbed Ionospheric Conditions," which were presented before the Radio Section of the Institution of Electrical Engineers on 9th February (*Electrical Review*, 11th February) was opened by Mr. F. Axon (B.B.C.). He referred to practical measures taken to overcome some of the difficulties to which the authors referred, such as broadcasts of the test matches; for the first match the percentage of reliability was about 30, while for the last no time had been lost. Forty-nine countries were now regularly rebroadcasting from the United Kingdom. If a country failed to rebroadcast the Queen's speech on Christmas Day it could not have been due to the ionosphere.

A major obstacle to short-wave broadcasting had been lack of data of the kind given by the authors. Lack of confidence in some countries in ability to forecast disturbances had led them to use two or three frequencies in different bands as an insurance, but this was of little benefit.

Mr. C. Millington (Marconi's) referred to the possibility of receiving a signal from, say, Melbourne at Barbados when it could not be received half-way, in London, the reason for which was still obscure. It was a reminder that there was almost international agreement to use the control-point method, which arose not from true theory but from observations on long-distance circuits.

Mr. A. F. Wilkins (D.S.I.R.) said that much of the scientific information concerning long-distance h.f. propagation accumulated over the last thirty years, which had not been published, would be of great interest to those concerned. One requirement was that the electron density in the F_2 region should be adequate to reflect the waves. An ionospheric index, based on the density of ionization in the F_2 region might be more satisfactory than a magnetic index. It would show the cause of a large amount of lost time at times of sunspot minimum when magnetic conditions were quiet.

Mr. H. Stanesby (G.P.O.) said that ability to predict future trends of circuit performance by examining past trends would be most useful. If circuit performance could be expected to deteriorate severely during the downward phase and towards the minimum of a sunspot cycle, precautions could be taken in advance to get the traffic through. Moreover, in examining the performance of radio circuits they could largely eliminate the variability introduced by solar phenomena and then see whether changes in the circuit led to improvements.

Diurnal Variation

Mr. H. F. Finch (Royal Observatory) emphasized the marked correlation between losses on transatlantic transmissions and the magnetic index and called attention to the diurnal variation, which appeared to be a local time effect and meant that over the Atlantic the period of maximum magnetic activity was between 20.00 and 02.00 hours.

Dr. R. L. Smith-Rose (D.S.I.R.) said the papers showed that the radio operating engineer was at last producing the information obtained from his circuits in a form useful to those who studied the physics of transmission and the preparation of forecasts. It was therefore important to secure agreement on some uniform and easily assimilable manner of presenting the data, particularly as the subject would become of international interest.

Mr. H. Leigh (G.P.O.) referred to ways in which the Post Office had followed up the suggestions made for improving the percentage of commercial time. The great circle path from New York to London passed uncomfortably close to the northern auroral zone, and since 1952 an experimental relay at Barbados had been used to divert the New York telephony circuit on winter nights and had roughly doubled the commercial time available. Aerial systems had also been designed for the daytime maximum traffic at about 15 Mc/s, and neither the rhombic nor the m.u.s.a. arrays were particularly efficient for the 5 Mc/s which had to be used at night in winter. In 1951 a large rhombic aerial had been built for low angles of transmission and reception, and when in 1954 the Americans provided two such aerials the gain in March last was found to average 27 db. The improvement was over 100 per cent and at least half was due to these aerials, of which a number would be in service by next winter. Before the next period of minimum sunspot activity they hoped to have the transatlantic telephone cable.

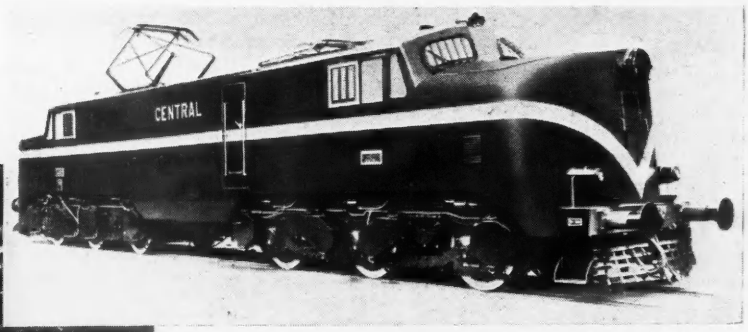
Mr. J. A. Smale (Cable & Wireless), commenting on the occurrence of the greatest amount of lost time during the night in winter, provided evidence that from 1933 to 1952 the most difficult times had been at the equinoxes, and also that the most difficult time of the day centred on 07.30 hours, and not, as the authors suggested, from 21.00 to 06.00 hours. In this connection, Mr. A. M. Humby remarked that a five-year analysis of the Halifax-London circuit showed the maximum disturbance in the spring, and between 06.00 hours and 09.30 hours.

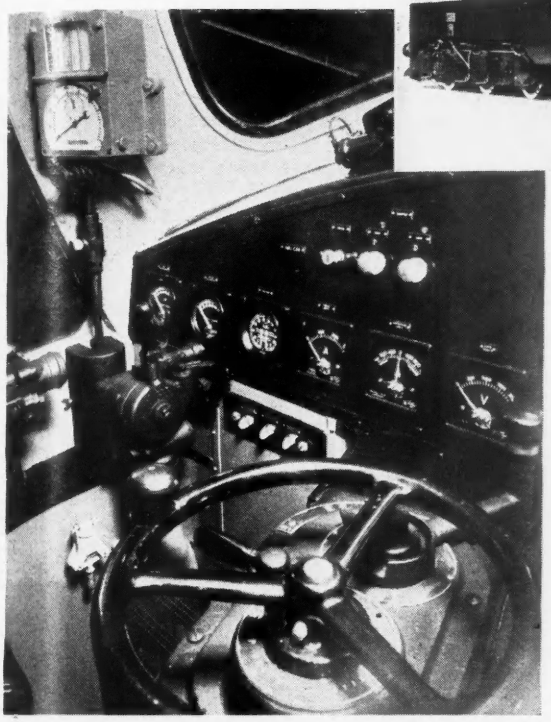
Revised Bulk Supply Tariff

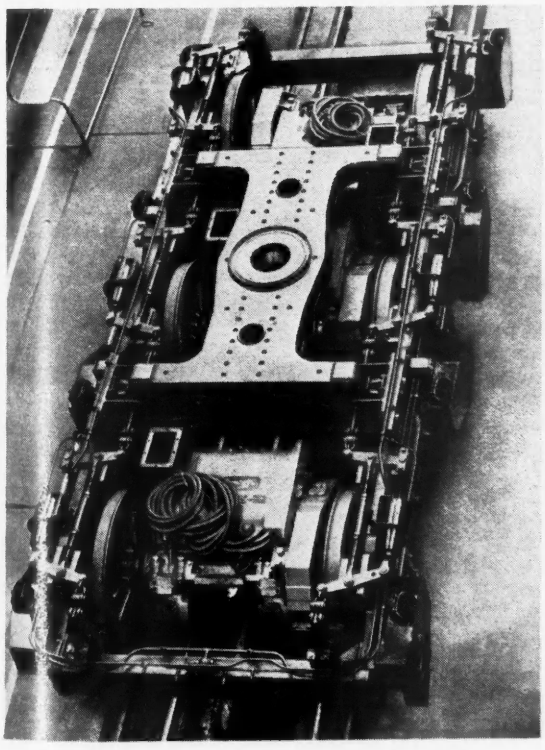
THE British Electricity Authority has given notice of a revised tariff for the supply of electricity to the twelve Area Boards in England and Wales for the year ending on 31st March, 1956. As hitherto, the tariff incorporates a fixed charge per kilowatt of maximum demand and a running charge per kWh consumed. It applies to all Area Boards on a uniform basis, subject only to regional fuel cost adjustment. Both the fixed kilowatt charge and the running charge remain the same as in the present tariff which came into force on 1st April, 1954, but the fuel price adjustment figure, which in that tariff had been reduced from 0·0007d to 0·00065d per penny variation in the cost per ton of fuel in the respective areas, has been further reduced to 0·0006d.

A new feature in the tariff is a provision for adjusting the maximum demand to which the fixed charge applies, if the sum of the demands on the Central Authority varies by more than 1 per cent from the estimate of total demands on which the charge in the tariff has been based. In such event, the chargeable maximum demand for each Area Board will be determined by adjusting their actual demand inversely as the sum of the actual demands varies from the estimated total demand. This provision will ensure that during the year of account the fixed kW charges in aggregate will correspond approximately with the Authority's fixed costs of supply during the year, regardless of any variations between the estimated and actual total demands due, for example, to extreme weather conditions, and will minimize the effect of such variations upon Area Board trading results.

DESCRIPTION OF ELECTRICAL EQUIPMENT







Locomotives for Indian Railways

THE first of seven Co-Co 3,600 h.p. electric locomotives ordered by the Indian Railways in November, 1951, from the English Electric Co., Ltd., has now arrived in Bombay. The locomotives are intended for operation on the Bombay-Poona (119 miles) and Bombay- Igatpuri (84 miles) sections of the Central Railway. Both routes include long 1 in 40 gradients with sharp curves, the Poona line including 15 miles continuously at this inclination. Maximum speed is 75 m.p.h. and operating speeds of both passenger and freight traffic will be considerably higher than hitherto. Principal dimensions and mechanical data are given in the accompanying table.

Gauge	5ft 6in	Weight of locomotive	123 tons
Length over buffers ...	68ft 4¼in	Weight per axle ...	20·5 tons
Maximum width ...	10ft 6in		
Maximum height (pantograph housed)	14ft 1in	Tractive effort:— Maximum at 25 per cent adhesion ...	69,000 lb
Wheel base of bogie...	15ft 9in	At one hour rating ...	48,000 lb (at 28·5 m.p.h.)
Distance between bogie centres ...	34ft 10in	At continuous rating	39,000 lb (at 30 m.p.h.)
Wheel diameter (new)	4ft 0in		
Minimum curve negotiable	350ft		

A double-bogie construction with a cab at each end, between which the roof is removable, has been adopted. Both bogies have three axles, each driven by a forced-ventilated nose-suspended motor through single-reduction resilient spur gears with a ratio of 59 to 16. The weight of the locomotive structure is transferred to each bogie through a fabricated bolster. The six 1,400 V motors are rated at 530 h.p. continuous running and 600 h.p. for one hour. Provision is made for the locomotive to run on flooded tracks during monsoon periods. Air and regenerative braking are employed for the locomotive and vacuum braking for the train. Service braking is controlled by a vacuum brake valve, which also operates, through a proportional valve, the air brakes on the locomotives. The latter can also be controlled independently by a self-lapping valve. Most of the control equipment is housed in two compartments and the main starting resistance is in two sections mounted on both sides of the locomotive. Behind the cab at one end is a motor generator and at the other end are two air compressors. Each of the two locomotive noses contains one exhauster and one traction motor blower.

Driver's controls for 3,600 h.p. locomotive and view of bogie from above

Auxiliary machines, like the traction motors, are rated in accordance with B.S. 173 for Class B insulation and, ventilating fan motors excepted, operate at the line voltage of 1,400 V. The motor generator consists of three machines on a common armature shaft—a motor and two generators. One generator provides excitation for the traction motors during regenerative braking; the other supplies, in conjunction with a battery, a regulated voltage of 110 for control gear, lighting and ventilating fan motors.

Of two motor-driven reciprocating exhausters, one is normally used, but both can be brought into operation to obtain rapid release of the train brakes. Increased quickness in release is secured by speeding up one of the exhausters. Two reciprocating compressors provide air for operating the locomotive brakes, control gear, sanding equipment and horns.

The master controller has a hand wheel for power notching and three levers all interlocked. One lever is for reversing and field weakening of the traction motors, one for regenerative notching and the third for the selection of motor grouping for regenerative braking. There are nine running notches, when no resistance is in the motor circuits, corresponding to all six motors in series, two parallel circuits of three motors in series and three parallel circuits of two in series. In each case the motors may be run with full, intermediate or weak fields.

Fourteen regenerative brake notches give series, series-parallel or parallel motor groupings. Regenerative braking is interlocked with the locomotive air brakes so as to hold up the air brakes during regeneration if the train vacuum brakes are applied, thereby eliminating risk of locking the locomotive wheels. Should regenerative braking be unobtainable an emergency brake is automatically applied. Should the driver apply the emergency brake regeneration automatically ceases. Half of the equipment would enable the locomotive to proceed if any item in the other half were to fail.

At starting the traction motors are connected in series, for intermediate speeds in two parallel groups of three motors in series and for the highest speeds in three parallel groups of two in series. In each transition the starting resistance is inserted and progressively cut out. For each motor grouping two higher speeds are obtainable by field weakening.

During regenerative braking while descending gradients, when electrical energy is returned to the line (thus reducing wear on brake blocks), the armatures are connected in series, series-parallel or parallel. The motor fields are connected in series and excited by current from the motor generator. The field of the exciter, which determines the amount of regeneration, is regulated by the master controller.

The locomotives were or are being built by the English Electric Co., Ltd., and the Vulcan Foundry, Ltd., which designed and manufactured the mechanical parts.

Alternator Failures

IN a paper which he presented before the Institution of Mechanical Engineers, Sir Claude Gibb (chairman and managing director, C. A. Parsons & Co., Ltd.) analysed possible causes of the breakdown last April of two 100 MW alternators (forming part of an order for four steam turbo-alternators) installed at the Richard L. Hearn power station, Toronto, of the Hydro-Electric Power Commission of Ontario. These sets took the peak loads of the system, he stated, their load varying from 10 to 100 per cent of maximum rating and they were shut down each night. As such conditions were peculiarly liable to cause coil distortion (a direct function of the number of heating and cooling cycles), the limiting of rotor temperature rise was a major consideration. Ventilation holes were therefore drilled in the end-bells, as these had been found to reduce temperatures by 7 to 15 deg C or more in earlier smaller machines.

Shortly after synchonizing No. 1 set on 1st April after its over-night shut down, flames appeared at the exciter end of the generator. An oil fire developed and was fed by the auxiliary oil pump, which automatically came into operation as the turbine speed fell.

Damage external to the generator, caused by the fracture of bearing housing, pedestals, main driving coupling and other parts, was relatively minor. Practically all the damage to auxiliaries, busbars, cables, structures and building was caused by the fire, in which 3,000 gal of oil was consumed. Its effects were limited mainly to the area of No. 1 set.

A similar sequence of events accompanied the failure of No. 2 set four mornings later, but mechanical damage to the bearing housing was not so extensive. The auxiliary oil pump was shut down early and the fire, in which 1,800 gal of oil was consumed, was not so prolonged. Hydrogen escaping from the damaged seal at the exciter end was probably first ignited and set fire to oil escaping from loosened oil pipes and drains. No hydrogen explosion or fire occurred within the stator casings, as was shown by the excellent condition of the stator and rotor windings at the turbine end of both machines. The end-bell of each rotor was fractured in one place radially and axially through a line of three ventilating holes. Rotor teeth were broken and stator end-windings at the exciter end had disintegrated. The rotors and end-bells were returned to England. Details were given of the exhaustive tests applied with particular reference to cyclic and residual stresses. All the available evidence confirmed the view that the breakdowns were due to the ventilating holes in the rotor end-bells.

With direct hydrogen cooling of the rotor the risk (formerly attached to direct air cooling) of drawing dust, carbon and oil vapour into the rotor windings would not have existed. Moreover the reduction in temperature thus given would have been more than that resulting from ventilating holes. The end-bells substituted were of a chrome-molybdenum alloy which was magnetic but the forging of end-bells that were non-magnetic (as was desirable for reducing heat and magnetizing current losses) was now feasible, provided the rotor was directly cooled by hydrogen.

One suggested cause of the failures was severe unbalance between phases, possibly due to the single-phase closing of a circuit breaker on a feeder carrying a considerable proportion of the output. This had been known to give rise in air-cooled machines to overheating of rotor slot wedges and to arcing between end-bell and rotor, when warning of severe negative-phase sequence was given by smoke escaping from the stator casing covers. While this suggestion was unsupported by the evidence, the need for some warning in the case of a hydrogen-cooled generator called for attention.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Anti-Static Rubber for Medical Use

MR. MULLER'S letter in your issue of 12th November, 1954, touches some of the problems which faced the drafters of the main British Standards on anti-static and conductive rubber (B.S. 2044 and 2050: 1953). These materials are liable to vary in resistance both by process of manufacture and on subsequent strain of the finished article so that it is only feasible in general to consider resistance in terms of orders of magnitude.

Fortunately, in considering the dissipation of static electricity, the resistance need only be defined to orders of magnitude, so that limits of 100,000 ohms to 10 megohms have been specified for new products in the British Standard, and not 1 megohm as mentioned by Mr. Muller. This figure allows for some further increase of resistance without loss of function. It is, of course, to be desired that the products should be within close limits of resistance, and manufacturers are asked to attempt to make them between 100,000 ohms to 1 megohm; the upper limit in the Standard, however, is 10 megohms.

This Committee will shortly review the experience of manufacturers and users of products during the past year, and is open to amend the limits as necessary, bearing in mind the need to maintain a lower limit of resistance with some products on safety grounds and effective anti-static properties at the upper limit.

Birmingham, 24. D. BULGIN,
Chairman, B.S.I. Committee RUC/2,
Anti-Static and Conductive Rubber.

Shortage of Technologists

WITH reference to "D.J.C.'s" letter and subsequent replies concerning the comparative salary grades of a showroom supervisor and a third assistant district engineer, I feel that the real point of the argument has been missed.

It is not the desire of professional engineers to lower the remuneration of their non-engineering associates in the industry, but rather to raise their own, commensurate with their long training and greater responsibilities.

Nowadays third assistant engineers are usually required to possess qualifications and experience leading to corporate membership of the Institution of Electrical Engineers. The minimum time in which these can be achieved is seven years. Moreover, they often hold responsibility for human lives and in the event of a mistake, can be prosecuted and charged with manslaughter. Apart from personality and practical experience of sales, what are the actual qualifications insisted upon for the position of showroom supervisor?

The science of engineering is universally recognized as a profession. On the Continent it enjoys the same (sometimes greater) status as law and medicine. It is the duty of professional engineers to ensure that engineering enjoys a comparative status in this country.

The whole question is one of ethics rather than expediency. A doctor has a definite status, both financial and social, by virtue of the fact that his profession demands it. He may be second rate and have little personality but there is a loyalty to his profession by its highest and lowest members which ensures the proper recognition of them all. This loyalty is missing in the engineering profession. Those of its members who have fought their way to the top have very often been too engrossed in achieving their own position to give much time to the profession as a whole.

"VIRTUTE ET NUMINE."

"All-Insulated" Equipment

REFERRING to the leaderette under the above title in the *Electrical Review* of 4th February, it may be argued that the user is less well protected by earthing than by additional insulation. The earthing may be carefully and frequently checked, but there is always a risk of a failure between the times that tests are made. These failures are very seldom obvious to the user until he receives a shock, when it is frequently too late.

Protective insulation, on the other hand, is something that is obvious and easily understood by most people, and if the outer protective material becomes damaged it is visible to the user and he has an opportunity to save himself from risks—an opportunity which is hardly ever afforded in the event of a failure of earth protection.

Shoreham-by-Sea. H. HOBBINS, A.M.I.E.E.

Industrial Frequency Traction

IN his paper "The Development of 50 c/s Traction in France," read before the Institution of Electrical Engineers last night, Mr. E. J. Davies of the British Thomson-Houston Co., Ltd., put forward the case for railway electrification to be carried out using industrial frequency a.c.

With the d.c. systems in use the advantages lay in the motors themselves, the drawback being the fixed installations. With a.c. supplied to the catenaries at 25 kV 50 c/s the cost of the fixed installation was estimated as 40 per cent lower than with d.c. Using a 50 c/s supply, substations could often be incorporated in a power station or an existing h.v. switching station. The reasons for the system not having been adopted before were the difficulty of constructing a suitable single-phase motor for traction work, and the fact that rectifiers were not regarded as robust enough for locomotive use.

Since the war the French Railways had first electrified the Paris-Lyons line at 1,500 V d.c. and had now electrified 550 miles of main track and 220 of secondary track in the area north of Paris. This was being done on 50 c/s a.c.

Of the 105 locomotives so far ordered, 65 had a single-phase motor driving two d.c. generators each of which fed three d.c. driving motors; five were ignition locomotives; 15 had single-phase variable-speed driving motors; and 20 had squirrel cage three-phase driving motors supplied via a phase changer and frequency changer, giving continuously variable-speed control.

A total of seven substations was required for the whole scheme only three of these being built specially by S.N.C.F. The other four were accommodated in existing electricity supply substations.

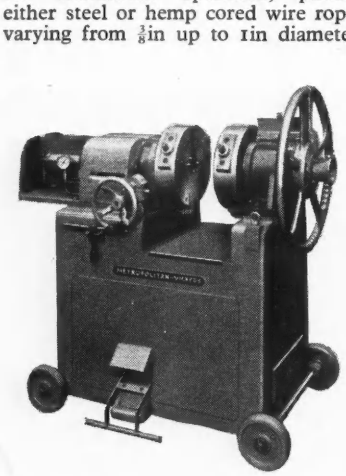
The author examined the types of single-phase motor used on this and on other Continental electrification schemes; and concluded that the arguments in favour of a.c. traction supply at industrial frequency were so strong that they could not be ignored in future work in this country.

NEW ELECTRICAL EQUIPMENT

Rope Parting Machine

The type HRP 25 wire rope parting machine made by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, 12, has recently been re-designed to include hydraulic transmission for applying the tension to the rope during parting. This reduces the effort required by the operator when compared with the original model where the tension was applied by means of a screw and large diameter handwheel.

The standard machine can be used for continuous operation, parting either steel or hemp cored wire ropes varying from $\frac{3}{8}$in up to 1in diameter,



Metropolitan-Vickers wire rope parting machine

with occasional operation on ropes of $1\frac{1}{8}$in diameter. As well as sealing and tapering the ends of ropes it can also be used to seal each individual strand without welding all the strands together.

The machine consists essentially of two clamping heads, each of which is fitted with two preset and one clamping jaw to enable different diameters of wire rope to be accommodated. The right-hand head can be turned in its bearings and is operated directly by the large diameter handwheel provided. The left-hand head slides in its bearings to stretch the rope and is operated by two small hydraulic cylinders, one on each side to give a balanced pull. These cylinders are piped to a small hand-operated gear type pump mounted at the left-hand side; a small header tank is provided at the rear to make good any leakage which may occur. The hydraulic transmission is completely self-contained. To enable the rope to be placed in position without threading through the machine both clamping heads are slotted along the top enabling the rope to be dropped into position.

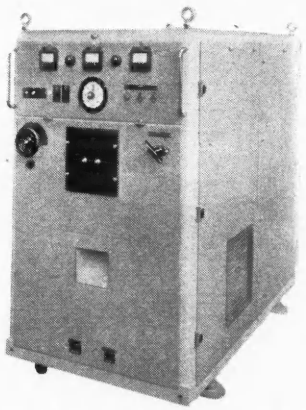
Each clamp is connected to the secondary winding of the 25 kVA air-cooled transformer mounted within the framework which supplies the low voltage heating current. This is controlled through a contactor by a foot switch mounted at the front of the machine. A tap changer with two control plugs gives the choice of eight heating speeds. The machine is normally mounted on wheels so that it can easily be moved if necessary from one wire rope to another.

12 kW Induction Heater

Because of its versatile output coupling arrangements, the 12 kW induction heater, type EH.120, made by E.M.I. FACTORIES, LTD., Hayes, Middlesex, can be used for a wide range of heating processes, either on a built-in work station or at a remote work station supplied through a transmission line. The generator is self-contained, the only external connection being to a three-phase supply. The r.f. power output is 12 kW for continuous, or 14 kW for intermittent working (50 per cent duty cycle) into work of high power factor, or 500 kVA and 700 kVA respectively into work of low power factor or where the coupling efficiency is low. A hand wheel provides a smooth control of the r.f. output voltage.

Work-matching capacitors in varying combinations up to 0·14 μF are incorporated, but in cases where r.f. power is fed to a remote work position via a transmission line, the capacitor can be readily omitted. The continuously variable output coupling system can be fed into a co-axial line, and a dual-range line ammeter on the control panel facilitates accurate matching to a transmission line and external work circuit.

A timing unit with built-in hour meter is incorporated, the normal



E.M.I. 12 kW induction heater type EH.120

range being 0-30 sec, but other ranges from 0-10 sec up to 0-4 hr are available. The air and water cooling arrangements are self-contained, and the equipment will operate continuously without any external water supply. The equipment is provided with extensive control and metering facilities, and is completely safeguarded against overload.

Detector Lamp

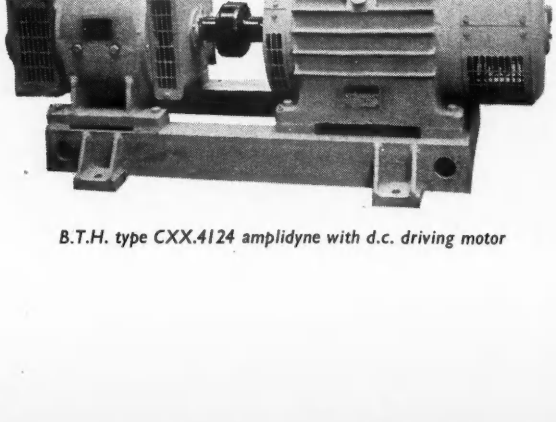
A multi-purpose detector lamp unit has recently been designed by "V" (DEVELOPMENT & TRADING), LTD., 22, Clifton Road, London, W.9, to facilitate the carrying and operating of special purpose lamps.

It comprises a 75 W or 120 W high pressure mercury vapour lamp with "Violet Black" glass, porcelain e.s. lampholder, ballast resistance tapped for 220/250 V, shield reflector, 9ft of flexible and adaptor. The unit measures 6in by 7in by $10\frac{1}{2}$in and weighs about 9 lb.

Instructional Amplidynes

An amplidyne for instructional purposes is now available from the BRITISH THOMSON-HOUSTON CO., LTD., Rugby. It is of the same general construction as the industrial machine but it has a terminal board instead of the normal terminal box.

The fields of the machine have been designed so that it may be used in a variety of ways. All leads from windings and brush-gear are brought out to separate terminals arranged in a diagrammatic layout on the terminal board, and a set of links is provided for making the normal amplidyne connections. A tapping is provided in the compensating winding of the equipment so that the operation of an under-compensated



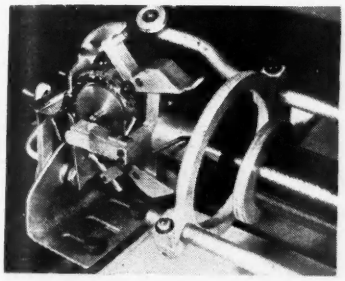
B.T.H. type CXX.4124 amplidyne with d.c. driving motor

"constant-current" type of machine may be demonstrated, while a divertor resistor allows of fine adjustment of compensation over a small range.

The college-type machine is available in two frame sizes, rated as follows:—Type CXX.3024—two poles, 1,410/1,500 r.p.m., 220 V, 3·6 A, 0·8 kW; type CXX.4124—two poles, 1,430/1,500 r.p.m., 200 V, 12·5 A, 2·5 kW. The amplidyne is usually supplied on a baseplate, driven through a quickly-detachable flexible coupling by either an a.c. or d.c. driving motor of standard industrial design. An illustrated instruction book is provided with each set, giving full details of operation, construction, and maintenance.

Armature Winder

The MIDLAND DYNAMO CO., LTD., 64, Belgrave Gate, Leicester, has developed a "Quickway" armature winder designed for multi-pole or short pitch armature, rotor, or inverted stator windings. The winding head illustrated shows the wire guides used with a "Quickway" high



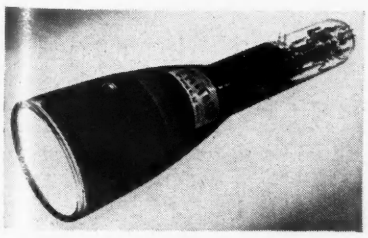
"Quickway" armature winder

speed production mechanism, similar to the Model 2(a) armature winding machine. The advantageous feature of the method is the visible laying and easy control of the wire, winding the turns neatly and tightly into the slots of each armature, which is held stationary, and is capable of dealing with a wide range of wire sizes from 16 to 46 gauge.

The illustration shows an inverted stator winding having a 1 to 3 coil pitch and is a typical example of the type of winding where very low productivity costs are possible.

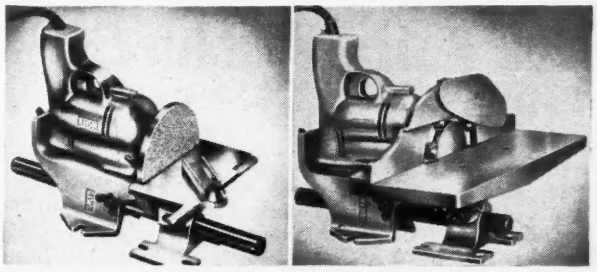
Oscillograph Tube

A new Emitron tube—type 4EP1—being made by ELECTRONIC TUBES, LTD., Kingsmead Works, High Wycombe, Bucks, has many features making for improved performance and reliability, especially where high frequency operation and high writing speed with good definition are required. Post-deflection acceleration confers the great advantage of high deflection sensitivity combined with good brightness, as compared with conventional tubes. The new 4EP1 tube gives a deflection sensitivity of about 1 mm/volt with a final accelerator potential of 2,000 V. For high writing speeds this voltage can be increased up to 8,000 V. Thus detailed studies of small amplitude waveforms can be made easily and with the minimum of amplification.



The Emitron type 4EP1 oscillograph tube

The use of side connections to the deflector plates allows the tube to operate at very high frequencies (i.e., with millimicrosecond pulses) due to the extremely low deflector plate capacity and inductance. Other features of this new Emitron tube include a 4in diameter screen with green fluorescence of medium persistence; beam trap for triggered operation; compact construction giving space economy in equipments—its length is only 15in; and specially designed all-glass construction for use under severe climatic conditions.



Wolf "Cub" No. 9 bench sander, and (right) No. 10 planer set

Portable Tool Accessories

Two additions to the "Cub" range of electric tools, a bench planer and a bench sanding set, are announced by WOLF ELECTRIC TOOLS, LTD., Hangar Lane, Ealing, W.5.

The planer is powered by the "Cub" drill and fitted with a specially designed planing head. The continuous cutting action eliminates difficulties of planing against the grain and the patent conical high speed cutters are claimed to last indefinitely under normal usage.

Owners of the "Cub" drill can add this set to their equipment for the cost of £3 9s 6d, while the complete bench planer, including the drill, bench clamp, pillar, and No. 10 planer set costs £10 13s 3d.

The No. 9 bench sander set, priced at £1 18s 6d, enables fine accurate finishing to be obtained at high speed on wood, metal, plastics and similar materials to a depth of 2¼in. To ensure maximum performance, self-adhesive sanding discs are provided in assorted grades to suit different work, and these can be instantly fixed to, or removed from, the face plate as desired. The set includes a handy bevel attachment which enables mitres and other angles to be sanded.

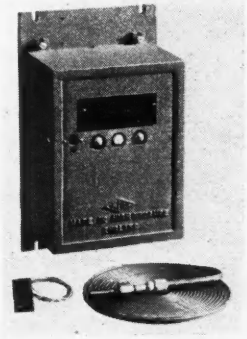
Inexpensive conversion packs to convert planers to sanders and vice versa are also available.

Temperature Control

A temperature control unit, type N856, announced by AIRMEC, LTD., High Wycombe, Bucks, is designed for the accurate control of the temperatures of platens, ovens, rooms, containers, liquids, gases, etc., in the very wide range of from −96 deg C to 428 deg C.

It normally utilizes a flat mica resistance type sensitive element which is mounted in close proximity to the medium to be controlled, but for immersion in liquids, use in corrosive or damp atmospheres, or for controlling temperatures above 300 deg C, a sealed platinum bulb thermometer may be employed as the temperature sensitive element.

The circuit arrangement enables the three conditions, "temperature low," "temperature correct" and "temperature high," to be detected, and the



Airmec temperature control unit type N856

unit can therefore be used to control not only electrically heated elements, but also heating or cooling processes using motor controlled valves, etc. The sensitivity of the equipment is such that the relays operate and release on changes of the control resistance of 0·1 per cent. This represents a temperature change of 0·25 deg C for the mica resistance element and 0·4 deg C for the platinum bulb thermometer at 100 deg C.

Railway Electrification Proposals

Debate on Borrowing Powers Bill

THE railway modernization plan, and the electrification proposals in particular, were welcomed by members of all parties in the House of Commons when the Transport (Borrowing Powers) Bill to increase the borrowing powers of the British Transport Commission from £275 million to £600 million, was given a second reading.

The Minister of Transport, Mr. John Boyd-Carpenter, explaining the financial proposals, said that there was a margin of £75 million for the first part of the modernization plan to be carried out from 1955 to 1959, but this did not represent all the capital expenditure which the Commission would undertake. Much of the early work would be on extra bridge renewals and track strengthening in preparation for higher train speeds and electrification. There would be the preliminary expenditure on automatic train control and new types of locomotive, and the first steps of the further electrification beyond Chelmsford to Ipswich. These were quite apart from the suburban electrification schemes which would be financed from the normal capital development. The whole plan would cost £1,200 million in the next 15 years. Large though this might seem, it was worth recalling that the House recently increased the borrowing powers of the British Electricity Authority to £1,400 million. Transport had been the Cinderella of the capital market and there was need for large investment in both forms, road and rail.

Types of Propulsion

It was vital as the plan developed to keep some flexibility between the two new proposed means of propulsion, diesel and electric, because as the years developed it would become apparent, particularly in marginal cases, which was the more economical. For instance, if the atomic generation of electric power resulted in a considerable fall in the price of electricity the Commission would be wise to extend the proportion of track to be electrified. But, clearly, there was room both for electrification in respect of high density traffic and for diesel propulsion for low density traffic.

Extensive electrification schemes were projected. In general, apart from the Southern Region, it was proposed to employ the overhead method, as used in some other countries. In the eastern part of the Southern Region the proposals involved the completion of an area already largely electrified, extending through to the Kent coast, and here the third rail system would be continued.

Work had begun on the extension beyond Shenfield towards Chelmsford and Southend and approval had been given for the first of the major engineering works on the London, Tilbury and Southend line. The Glasgow suburban lines electrification scheme was being considered by a committee, presided over by Sir Ian Bolton, which was discussing the repercussions which the scheme would have on the existing local transport system.

These electrification proposals would benefit both the public and the Commission. On the Manchester-Glossop section of the newly electrified Manchester-Sheffield line passenger traffic had increased by 137 per cent since electrification. Similarly, new services operating in West Yorkshire had brought considerably increased traffic.

Viscount Hinchingbrooke confessed that his pet idea for the railways was gas turbines. He believed they ought to be used in electric power stations, in locomotives and many other ways because they were the best means of creating a proper fuel and power policy which would make full use of our resources and help to get rid of "smog." British Railways had experimented with gas turbine engines which were too big and heavy.

Mr. Gerald Nabarro said there was a special case for electrifying the lines near the sources of water power. France, Norway, Switzerland, in fact every country in the world which had hydro-electric works, developed water power in unison with the electrification of railway lines adjoining or contiguous to the sources of power. He was therefore disappointed that the advice of Mr. Tom Johnston, chairman of the North of Scotland Hydro-Electric Board, had not been taken and that the Transport Commission had omitted any electrification schemes in Scotland except for the heavily-loaded suburban routes in the vicinity of Glasgow and Edinburgh.

A second important relationship between power and railway development was in the enormously expensive investment in power stations—£170 million a year. Mr. Nabarro said he thought this large scale of investment was justified, subject to the important caveat that the assets being created should be used to optimum efficiency. Electrification of the railways provided a unique diversified load for 24 hours, an off-peak load, and call-off for power at all hours of the night.

Electricity and Transport Co-ordination

There was a great need for proper co-ordination between the electricity and transport industries. Alongside the railway line from London to Crewe there were wide tracts of country where electricity had not yet been supplied to farms, villages and hamlets. A parallel development for railway electrification and the transformation of electricity to provide supplies to contiguous rural areas would mean that substantial sums could be saved in capital investment.

The greatest industrial area, that around Birmingham, had been omitted from the electrification scheme but he thought that great relief from traffic congestion would be obtained by bringing into use again many disused railway lines in the area and using them as surface approach routes to a tube railway beneath Birmingham. This system could extend from Coventry in the south to Wolverhampton in the north, Sutton Coldfield in the east, and Kidderminster in the west.

Mr. William Reid, on behalf of Glasgow Corporation, assured the Minister of Transport that the Corporation would co-operate to make the £18 million Glasgow electrification scheme a success.

Mr. W. R. Rees-Davies said that the electrification plan as it affected the eastern part of the Southern Region left people guessing. He urged that all the south-east coast lines, from Thanet to Portsmouth, should be electrified in the next three years and a start should be made at Gillingham and Ashford next year.

Gas Turbine Development

Replying to the debate, Mr. Molson, Parliamentary Secretary, Ministry of Transport, said that there was a widespread opinion that the gas turbine, already such an effective engine for aircraft, would become the most efficient engine for terrestrial propulsion. At present, however, the diesel was a good deal more efficient. One of the leaders of the motor industry had told him that the gas turbine would certainly come, but, owing to difficult technical problems of cooling, etc., it would be 10 years before it replaced the diesel. He was sure, therefore, that the Commission was right to go ahead with diesels. Experiments were being carried out with a gas turbine produced in co-operation with the Ministry of Fuel and Power. The Transport Commission would shortly be calling for tenders for diesels and he had no doubt that British firms, who were already exporting diesels to all parts of the world, would be successful in competition with foreign firms.

Parliamentary Report

REPLYING to a question in the House of Commons last week, Mr. J. R. Bevins, Parliamentary Secretary, Ministry of Works, said that the number of staff at the Fuel Research Station in 1953-54 was 292 and expenditure incurred was £268,535. Now the staff numbered 311 and the estimated expenditure for 1954-55 was £295,550.

Mr. Remnant asked the Chancellor of the Exchequer when he expected to give a decision about implementing the Beaver Committee's recommendation as to purchase tax on domestic fuel appliances. Mr. R. A. Butler replied that this was one of a number of matters arising on the Committee's Report which were now being examined.

Automatic Factories

Mr. Arthur Skeffington asked what experiments the Department of Scientific and Industrial Research was carrying out to create a fully automatic factory.

Mr. Bevins, Parliamentary Secretary, Ministry of Works, said that the National Physical Laboratory was conducting experimental work on electric computers and on methods for the electronic control of machine tools. The Department was keeping in touch with developments at home and abroad.

Mr. Skeffington asked if the Minister realized what very considerable progress had been made in this field in the United States, and if he would give every encouragement to the D.S.I.R. by allocating extra finance.

Mr. Bevins replied that the Government certainly did not underrate the great importance of this work, but the limiting factor at the moment was the difficulty of getting the highly specialized staff.

Mr. Arthur Woodburn said that according to his information the work that was going on in Edinburgh in this field was not at all behind that of the United States.

Mr. Bevins agreed that this was true.

Southend Line Electrification

Mr. McAdden asked the Minister of Transport and Civil Aviation when he now expected the electrification of the Fenchurch Street-Shoeburyness railway to be completed.

Mr. Boyd-Carpenter said that planning and survey work was going ahead, and one major engineering work had already been authorized. The date of completion depended, among other things, on the availability of the necessary equipment.

Mr. McAdden asked if the Minister's attention had been called to the speed with which the Dutch carried out electrification of their railways—at the rate of 1 km a day. Would he ask the Transport Commission to get a move on?

Mr. Boyd-Carpenter: "The task here is very much greater than in Holland, though I agree it is wise to learn from the example of other countries where the authorities carry out a job efficiently."

Telephone "Self-Help" Scheme

Mr. Steele asked the Assistant Postmaster-General if he would consider extending the self-help scheme for the installation of telephones to all applicants in rural areas.

Mr. Gammans said that this scheme, which had its own difficulties, was introduced as a quite exceptional concession to farmers because of the importance of food production, and he regretted that it could not be extended.

Electricity Tariffs

Mr. Victor Collins asked the Minister of Fuel and Power what were the highest and lowest charges for electricity in Great Britain; what were the regions in which these charges applied; and what progress had been made in the standardization of charges.

Mr. Geoffrey Lloyd replied that comparable figures could not be given because allowance must be made in each case for the relevant conditions attaching to the tariff. Most Boards had now published a standard tariff for each class of consumer, and even where this had not been done considerable progress towards standardization had been made.

Mr. Collins asked if the Minister was aware of the wide disparity in the charges to people on two-part tariffs and those charged by slot meter in the same region, with the result that the poorer people, who usually paid by meter, had to bear a disproportionate burden of the cost? Would the Minister press the electricity authority to make the charges more equitable?

Mr. Lloyd said he would not like to deal with that question without notice.

Electricity Board [Appointments]

Mr. Palmer asked the Minister if he would state the lapse of time between the vacancies arising and the appointment of new chairmen to the North Eastern and Southern Electricity Boards.

Mr. Geoffrey Lloyd said that the periods were six months and one month respectively. In reply to a further question Mr. Lloyd said that the time was abnormal and there were abnormal reasons.

Rural Supplies

Brigadier Peto asked the Minister if he was aware that the standard of supply of electricity to rural areas, and to farms in particular, varied in the areas of the different Boards, and if he would issue a general direction to the British Electricity Authority that priority must now be given to the areas which lagged behind, in order to achieve a uniform standard.

Mr. Geoffrey Lloyd said he appreciated Brig. Peto's concern but different areas had different problems and he did not think a direction would help.

New Bills

The Blyth Generating Station (Ancillary Powers) Bill, promoted by the British Electricity Authority, has been given a second reading in the House of Lords and referred to a committee. Petitions against the Bill have been lodged by the Northumberland County Council, the Northumberland and Tyneside River Board, the Northumberland Sea Fisheries Committee and Town Councils in the same area. Another House of Lords Committee is to consider the North Wales Hydro-Electric Power Bill. Petitions opposing the Bill have been lodged by the Cardiganshire County Council, Montgomeryshire County Council, Aberystwyth Corporation, the Festiniog Railway Company, the South West Wales River Board, the Council for the Preservation of Rural Wales and other associations.

SIGN DESIGN COMPETITION

The illuminated sign design competition sponsored by the Electrical Sign Manufacturers' Association has been won by Mr. J. K. W. Hopgood, of New Southgate, London, N.11. He will receive a cheque for £100. The second prize (£50) has been awarded to Mr. R. W. Pepper, Welling, Kent. On the recommendation of the judges, one of the three consolation prizes of £25 has been made into a third prize and increased to £35. The winner of this prize is Mr. Stanley Rickard, Mitcham, Surrey. The other two consolation prizes (£25 each) go to Mr. F. T. Oliver, Westcliff-on-Sea, and Mr. P. Watkinson, A.R.I.B.A., Leeds. The entry of Mr. J. M. Burford, Birmingham, was commended by the judges. Altogether there were 92 entries for the competition. The prizes will be awarded at a luncheon to be held on 9th March at the Savoy Hotel, London, when the chief guest will be Mr. William Deedes, M.P., Parliamentary Secretary to the Ministry of Housing and Local Government.

E.A.W.'s New Address

On and after 21st February all communications for Dame Caroline Haslett, D.B.E., J.P., and for the Electrical Association for Women should be addressed to 45, Eastcastle Street, London, W.1 (telephone: Langham 9571).

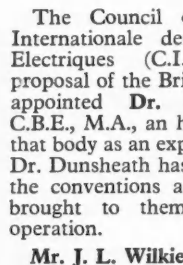
PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Council of the Conférence Internationale des Grands Réseaux Electriques (C.I.G.R.E.), on the proposal of the British Committee, has appointed **Dr. Percy Dunsheath,** C.B.E., M.A., an honorary member of that body as an expression of gratitude. Dr. Dunsheath has attended nearly all the conventions and his efforts have brought to them an efficient co-operation.

Mr. J. L. Wilkie, C.A., has resigned his position as secretary of Radio Rentals, Ltd., and is now commercial director. He is succeeded as secretary by **Mr. A. O. B. Wall,** C.A.

Mr. A. H. Gambling, after nine years with the appliances and installation equipment division of the B.E.A.M.A., is leaving the Association at the end of this month to take up an appointment with Hartley-Baird, Ltd., as personal assistant to the managing director.



Mr. A. H. Gambling

Mr. Gambling joined the B.E.A.M.A. in January, 1946, as secretary to the domestic electrical appliances section, subsequently taking over the duties of secretary to the domestic electric cooker section in addition. He was appointed secretary to the Associated Manufacturers of Domestic Electrical Appliances (A.M.D.E.A.) and the Associated Manufacturers of Domestic Electric Cookers (A.M.D.E.C.) when these Associations were formed in 1949. Mr. Gambling's other activities included chairmanship of the B.E.A.M.A. Cooker Technical Committee and secretaryship of the British Industries Fair Electrical Exhibitors' Committee.

Mr. D. H. Ray, B.Sc., M.I.E.E., A.C.T.(Birm.), assistant head of the Department of Electrical Engineering, College of Technology, Birmingham, is taking up the position of head of the Engineering Department, Mid-Essex Technical College and School of Art, Chelmsford, in April. Mr. Ray served his apprenticeship with the Shropshire, Worcestershire & Staffordshire Electric Power Co. and became assistant to the chief control engineer. He was released from the Army for training of radio mechanics at the College of Technology, Birmingham, where he took a permanent appointment after the war. He is secretary of the South Midland Education Discussion Circle of the I.E.E.

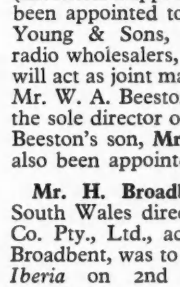
The Minister of Fuel and Power has appointed **Mr. Tristram Beresford,** of Chilmark, Salisbury, as a part-time member of the South Western Electricity Board in place of **Mr. G. H. Johnstone,** O.B.E., D.L., who is to retire on completion of his term of office on 31st March next.

Mr. H. M. Medland, J.P., of Peverell, Plymouth, has been re-appointed as a part-time member of the Board.

Mr. R. Lowe, chairman and managing director of Mansfield Factors (Electrical Supplies), Ltd., has recently been appointed to the board of T. D. Young & Sons, Ltd., electrical and radio wholesalers, of Nottingham. He will act as joint managing director with Mr. W. A. Beeston, who was formerly the sole director of the company. Mr. Beeston's son, **Mr. D. F. Beeston,** has also been appointed to the board.

Mr. H. Broadbent, resident New South Wales director for H. Rowe & Co. Pty., Ltd., accompanied by Mrs. Broadbent, was to leave Sydney on the *Iberia* on 2nd February for an extended overseas trip. He will visit the company's overseas principals, and attend the Rheostatic Co.'s international conference at Slough. Mr. Broadbent will visit Germany, Czechoslovakia, Spain, Portugal, Italy and France and the United States.

Mr. R. M. Campbell has joined the board of Gresham Transformers, Ltd. A management consultant by profession, he is an executive of the Wallace Attwood Co. with a wide experience of correlating the functions of sales, design and production departments, both in this country and the United States.



Mr. R. M. Campbell

The Metropolitan-Vickers Electrical Co., Ltd., announces that **Mr. R. P. Horlock,** B.Sc., A.C.G.I., M.I.E.E., has been transferred to the Metropolitan-Vickers Electrical Export Co. as manager for Canada. **Mr. R. S. D. Bagnall,** D.F.H., M.I.E.E., Mem.A.I.E.E., has succeeded Mr. Horlock as manager, Sheffield office.

Mr. Horlock joined Metropolitan-Vickers as a college apprentice in 1928 and was subsequently in the rolling mill section of the Plant Engineering Department. After a short period in the company's London office and further work in the Plant Department he was appointed manager, Leeds sub-office, in 1941. In 1947 he became manager, Sheffield office. His present appointment dates from 1st September, 1954. Mr. Horlock served for twelve years on the committee of the North Midland Centre of the Institution of Electrical Engineers and was chairman in 1948-49.

Mr. R. P. Horlock

Mr. R. S. D. Bagnall

Mr. Bagnall also went to Metropolitan-Vickers as a college apprentice, in 1933, and following a period in the Motor Engineering Department he joined the Bombay office of A.E.I. (India) in 1938. From 1941 he was with the Admiralty, first in Ceylon and then under the Dockyard Directorate at Bath. After the war he joined the Brush Electrical Engineering Co., being London office manager from 1947 to 1952, and later became a member of the local board of directors at Loughborough. On resigning this position he was appointed manager, Metropolitan-Vickers Sheffield office, as from 15th November, 1954.

At a general meeting of the Technical Publications Association which was held in London on 3rd February Mr. **C. E. Cunliffe,** manager of the Publicity and Publications Department of A. C. Cossor, Ltd., was elected chairman of the new Council.

Mr. Arthur H. Young, A.M.I.E.E., has been appointed a joint managing director of Troughton & Young, Ltd.

The demonstration team of the English Electric Company's Domestic Appliance and Television Division is being increased and re-organized. Overall control of the team remains with **Mrs. May Pearce,** senior housecraft adviser, and responsibility for day-to-day administration of the team's work is to be taken over by two senior demonstrators. **Mrs. K. Bellamy** will take charge of Southern, South-Eastern and South-Western England, South Wales and the Midland and East Midland areas, and **Mrs. G. Rawlinson,** based at the Leeds office,

will have charge in Northern England, responsible for the demonstrators working in Yorkshire, the North-West, the North-East and on Merseyside.

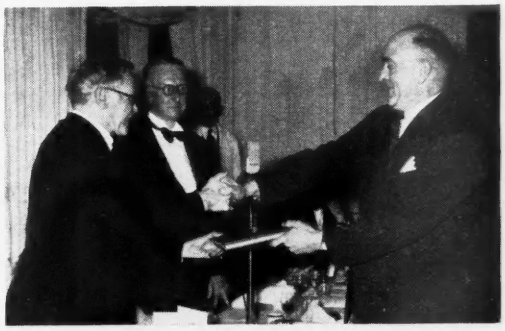
Mr. and the Hon. Mrs. Leslie Gamage recently arrived at Johannesburg airport on the first stage of their world tour. They are seen in the accompanying photograph being greeted by Colonel J. J. Kruger, a member of the South African Transport Commission and a Commissioner for the St. John Ambulance Brigade for Northern Transvaal. Mr. Gamage, who is vice-chairman and joint managing director of the General Electric Co., Ltd., was visiting the company's branches in the Union. The Hon. Mrs. Gamage is a Dame of the Order of St. John of Jerusalem.

Mr. and the Hon. Mrs. Leslie Gamage being greeted by Col. J. J. Kruger at Johannesburg

The Midlands Branch of the **Electrical Trades' Commercial Travellers' Association** held its annual smoking concert at Birmingham recently. It was well attended by members and friends. Mr. R. A. Capel (Foster Electrical Supplies), branch chairman, presided and a warm welcome was extended to Mr. Arthur T. Haywood (Electrical Components), president of the Association. The entertainment was arranged by Messrs. T. C. Browne (B.T.H.) and C. J. Nash (G.E.C.). The branch is holding its annual ladies' evening at the Queens Hotel, Birmingham, on Friday, 25th March.

Left to right: The Lord Mayor of London, Mr. H. J. Randall (chairman, L.E.B.) and Mr. D. B. Irving (deputy chairman) after the opening of the new substation at Seacoal Lane, Old Bailey *(see page 250)*

A dinner party was given by **M. K. Electric, Ltd.,** on 8th February to celebrate the thirty-sixth anniversary of the foundation of the company and to present awards to long-service employees. Mr. C. L. Arnold, founder director and general manager, was in the chair. Thirty-five employees of the company, including three executive directors, received gold watches in token of continuous service of twenty-five years or over. Thirteen of the recipients had been with M.K. for over thirty years. The presentation was made by Mrs. Arnold. Later in the evening Mr. Arnold was presented with a book containing the signatures of 1,300 employees of the company as a memento of the occasion. Altogether more than 150 guests attended the party.



Mr. C. L. Arnold (left) receiving a book containing the signatures of M.K. Electric employees from Mr. J. A. Brett, the company's longest-serving employee

George Kent, Ltd., announce that **Mr. C. W. Chandler** has been appointed manager of their Hibbert Street Works, Luton.

The second tournament of the season was held by the **Telcon Amateur Boxing Club** in the canteen of the Greenwich works of the Telegraph Construction & Maintenance Co., Ltd., on 7th February, before a crowd of nearly 500. The prizes were presented by Mr. J. N. Dean, chairman of Telcon, and other executives present included Mr. R. F. Harvey (manager, cables division), Mr. H. F. Wilson (technical controller), Mr. F. S. H. Lemon (manager, submarine cables) and Mr. R. C. Mildner (manager, technical and research) with their ladies.

The Staff Association of the **Telegraph Construction & Maintenance Co., Ltd.,** and **Submarine Cables, Ltd.,** held its seventh annual dinner and dance at the Dorchester Hotel on 11th February. Nearly 450 members and their guests heard Mr. J. N. Dean, chairman of both companies, reply to Mr. I. C. Coombs, deputy chief accountant, who proposed the toast of the company. Mr. W. F. Randall, director of Telcon, proposed the toast of the Staff Association and Mr. W. R. Martin, personnel manager and chairman of the Council, replied. Among the directors present were Dr. E. W. Smith, Mr. I. Innes, C.B., and Mr. W. Glass, with their ladies.

The annual dinner and dance of **Southern United Telephone Cables, Ltd.,** was held on Friday last at the May Fair Hotel, London, and was attended by over 300 members of the staff and guests. In proposing the toast of the company, Mr. J. G. Ellis (Outside Contracts Department) expressed regret that the chairman, Mr. W. F. Bishop, was unable to be present owing to illness. In the course of his remarks he referred to the fine efforts that the company had made in connection with the Newfoundland cable, resulting in their being ahead of schedule in the production programme. Mr. F. Waine (director) responded. The toast "Our Guests" was proposed by Mr. A. T. C. Moore (chief engineer) and Mr. E. W. R. Mason briefly replied. Following dinner there was an excellent cabaret and dancing continued until 2 a.m.

OBITUARY

Mr. Herbert Stirling Carnegie, whose death on 4th February at the age of sixty-seven was recorded in our last issue, had had a distinguished career and in the course of his duties with the English Electric Co., Ltd., he had travelled extensively in various parts of the world, including Australia, Canada, India, South Africa and America. Mr. Carnegie studied under Professor Silvanus P. Thompson at Finsbury Technical College, where he obtained a diploma. This was followed by a year's study under Professor E. Arnold at the Technische Hochschule, Karlsruhe, Baden, Germany. In 1914 he joined Siemens Brothers Dynamo Works (now the English Electric Co.) and after military service throughout the 1914-18 war he returned to the company, working in Glasgow, Liverpool, London and then Stafford. After holding various important positions he was appointed deputy chief engineer (general) of the English Electric Co. in 1943 and at the time of his death he was consultant to the Directorate of Engineering and head of the Special Engineering Section, Stafford. He was a member

The late Mr. H. S. Carnegie

of the Institutions of Electrical and Mechanical Engineers and author of several technical papers.

Mr. A. C. Dunnill.—The death occurred on 12th February of Mr. A. C. Dunnill, sales director of Hailwood & Ackroyd, Ltd. He joined the company in 1935 and for some years represented the company's interests in the Birmingham area. At the end of the war he was appointed sales director and occupied that position until his death. The cremation took place at Croydon on Wednesday last.

Mr. John Boon. — The death occurred suddenly at his home on 8th February of Mr. John Boon, superintendent of the Great Yarmouth power station since 1949. He was fifty-three. Mr. Boon commenced his service in the industry as an apprentice at the Ipswich power station in 1915, later becoming assistant superintendent. He was chairman of the East Anglian Section of the Electric Power Engineers' Association for several years.

WILL.—Mr. E. N. Bray, founder of Bray, Markham & Reiss, Ltd., and who later formed E. N. Bray, Ltd., who died on 18th October last, left unsettled estate valued at £7,488 gross (£7,306 net).

PUBLIC SPEAKING COMPETITION

There will be sixteen competitors—eight men and eight women—in this year's national finals of the E.D.A. Public Speaking Competition, which will be held in London in May. Half of the area finals have already been held. The competition's premier awards, the Faraday Silver Challenge Shields, will be held for one year by the Area Boards from which the winners come, the individual winners receiving replicas. Since it was introduced in 1949, the women's shield has been won twice by the North Western and Yorkshire Boards and once each by the Eastern and Merseyside and North Wales Boards. The South Western Board is the only one to have won the men's shield twice; the Merseyside and North Wales, North Eastern, North Western and South East Scotland Boards have held it once each.

The results of the four women's area contests so far held are:—Midlands: Miss J. M. Hughes (Walsall). Eastern: Miss Jean M. Padfield (Bishops Stortford). Southern: Miss P. Jenkins (Oxford) (In this area the Southern, South Wales and South Western Boards combined). Merseyside and North Wales: Mrs. L. Blease (St. Helens).

The four men who have already reached the national final are:—Eastern: Mr. B. A. Ward (Harrow). South Western: Mr. R. G. Charlton (Bath). Merseyside and North Wales: Mr. K. D. Brown (Chester). South Eastern: Mr. C. J. White (Hove).

Radioactive Isotopes in Industry

AN exhibition opened at the Birmingham Exchange and Engineering Centre on Monday is planned to interest all connected with industry in the possibilities for economy and speed latent in the use of radioactive isotopes on research and routine tasks.

One well-known application demonstrated is the use of a gamma ray source for the radiography of castings, welds, etc., including apparatus for doing this in pipelines at any point up to 30ft from an opening. The cost of a gamma ray source from Harwell for this purpose is quoted at about £5, with a half life of six years.

Great savings in time on wear measurement in engines are made possible. One of the wearing surfaces is first made radioactive in a Harwell pile and the amount of radioactivity in the lubricant measured as it appears. In this way measurements of wear can be made after an hour instead of 1,000 hours or so by normal methods.

Another application gaining favour is the continuous control of thickness in a sheet material such as textile fabric, metal sheet, paper, linoleum, etc., by measuring the attenuation of beta radiation passing through the sheet. The measurement is carried out by electronic means and an extension of the system can provide automatic correction of thickness as soon as a tendency to vary develops. An advantage of the system is that no contact has to be made with the material. An accuracy of 0·025 per cent is claimed for the method. An alternative or extra facility is the control of thickness of a coating on a base material, such as wax on paper or tin on steel. Commercial apparatus of this nature is shown in the exhibition by Ekco Electronics, Ltd.

Nylon and similar fabrics easily become charged with static electricity and readily attract dirt or dust particles. It is found that by mounting a small source containing a weak thallium isotope in the vicinity of the nylon and directed away from the operator the charge is dissipated. This improves the machine handling of the yarn and keeps it much cleaner.

Dr. Henry Seligman, director of the Isotopes Division at Harwell, opened the exhibition and was introduced by the Lord Mayor of Birmingham. Stress was laid on the fact that Britain is now the largest supplier of radioactive isotopes in the world and that even in the U.S.A. users find it quicker and cheaper to order them from Britain than from their own country. A large range of isotopes is available, ranging from Cobalt 60, the strongest, or "hardest" in nuclear parlance, to Thallium 170, the "softest," and a catalogue and price list is available from the Isotope Division of the Atomic Energy Research Establishment, Harwell.

Details are also available at the exhibition of the Isotope School at Harwell, training personnel from industry, research centres, medicine, etc. in a continuous series of one month courses. These are already fully booked until the end of October.

Trade and Technical Literature

A GREAT deal of information concerning products, plant and equipment is distributed to potential purchasers and users in the form of catalogues, brochures and similar publications. Some of this material is designed exclusively for its transitory sales appeal, but most of it is intended to be retained for reference purposes.

The wide range of sizes in which such literature has hitherto been issued made efficient filing a difficult and unsatisfactory business. At the request of the Ministry of Works and the Royal Institute of British Architects, BS.1311 was issued in 1946 recommending sizes of sales literature for use in the building industry. These recommendations have been followed very widely and evidence shows that this has been of great assistance to all concerned.

At the request of a number of organizations a revised edition of the standard has been prepared and it is now available at 2s 6d from the British Standards Institution, 2, Park Street, London, W.1. This extension of the scope of the standard has necessitated the omission of the recommendations concerning thickness, weight, titling and sequence of contents. The new standard specifies the sizes of manufacturers' and suppliers' trade and technical literature, including catalogues, brochures, leaflets and books containing technical information, working and operating instruction sheets, data sheets and erection and installation instruction sheets for plant and equipment. The appendices list the type of information that is generally required in catalogues and similar literature, explain the basis on which the standard sizes have been selected and give information concerning the international standardization of paper sizes.

It has not been considered practicable to recommend only one size for all types of trade and technical literature, but it is recommended that each organization should choose either 11in by 8½in or 8½in by 5½in as its standard page size with a tolerance of $\pm\frac{1}{16}$in.

VIEWS on the NEWS

By REFLECTOR

MORE and more "waste" products are being found to have hidden virtues. Power station ash, the disposal of which has so long been a problem, is now being sold for harbour construction works at Aden. More surprising still, I learn that even "smoke" from generating stations may in future contribute to the well-being of mankind. This intriguing suggestion was made recently by Dr. G. D. Muir in an address to the Bournemouth Natural Science Society on "Food Culture from Micro-organisms." The following is an extract:—

> "It has long been known that unicellular green algæ can be grown in fresh or salt water if supplied with nutrient materials and carbon dioxide, with free access to light. Each cell is rich in substances of great value as food for water or land animals and even for man if mixed in a palatable diet. So if a harvest of these algæ can be quickly gathered, a potential source of enormous value is presented. The amount of carbon dioxide discharged in the form of waste gases from power stations if it were purified and led into suitably designed tanks for culture of micro-plants could soon supply the requirements of the entire world in protein and also contribute in a massive way to meeting the demand for fats."

Dr. Muir spoke of research being conducted at Poole power station which, he said, was beginning to yield gratifying results in the growth of special strains of algæ. May it be that in time electricity will itself become a by-product?

* * *

Electricity is "fashionable" in Ireland just now—in more senses than one. I have before me a series of attractive photographs of the spring collection of models introduced by Miss Neilli Mulcahy who, I am told, is one of the youngest and most promising of Irish fashion designers. For these she has chosen electrical names, including "Circuit Breaker," "Short Circuit," and "Pyrothenax" (in the last-named the spelling seems to have been slightly varied). "Circuit Breaker" is (to me) mysteriously described as:—

> "A sports outfit consisting of brown flecked tweed jeans and scarlet bawneen middy top with zipped fastening and large collar. An attractive feature is the buttoned fastening at the trouser cuff."

Perhaps some member of the E.A.W. will say whether the electrical term is an apt one.

* * *

It has been suggested that with the conversion of the railways to electric and diesel operation they will lose some of the romantic appeal associated with the steam engine. Recently I expressed disagreement with this view and in this I am supported by the secretary of a Sheffield society of railway enthusiasts. He claims that the plans of the Transport Commission will mean added interest to his members, adding that they are by no means put out by the approaching end of the steam locomotive and are pleased that the travelling public are to get better and cleaner trains. That, after all, should be the main objective.

* * *

The energetic steps that are being taken by large engineering concerns to solve the problem of the shortage of recruits are illustrated by the series of "Careers" advertisements in the *Manchester Guardian* to which I have previously referred. The latest of these, by Simon-Carves and E.M.I., offer a wide variety of openings with good prospects both for school leavers and university graduates. Everything possible is done to ensure that recruits are given the positions most suited to them. For instance, Simon-Carves state that they will, if necessary, arrange an interview with a psychologist to supplement the normal aptitude tests. Two cases are cited to show how people whose background was not promising had been able to achieve success. In one, a boy who had missed much of his normal schooling through ill-health and was barely literate at sixteen was found to have a good aptitude for drawing office training. He is now a skilled draughtsman instead of perhaps remaining an "inefficient, frustrated citizen with no hope of skilled employment."

* * *

Perhaps I was a bit too playful when, recently, I construed Hauptberatungsstelle für Elektricitätsanwendung as "Chief Advice Place for Electricity Employment (or Application)." Mr. John Smuts (London, N.8) thinks that I was not quite fair to the German language. He says that a more accurate literal translation is "Main Advisory Office for Application of Electricity." However that may be it is still interesting to hear of the Germans adopting or adapting an E.D.A. theme for use in their electrical propaganda.

* * *

Seventy years ago the activities of the "dynamitards," who presumably sought to complete the work of Guy Fawkes, resulted in steps being taken to ensure the safety of the Houses of Parliament. According to the *Electrical Review* of 14th February, 1885, an experiment was carried out in which a Skrivanov battery was attached to a 600 c.p. arc lamp to project a beam of light from a police launch on to the terrace of the building. The occupants of the boat found that

> "From a distance of thirty yards, or thereabouts, the blinking features of a persecuted policeman were distinctly visible, while every outline of the floral masonry was seen as clearly as in daytime. The police officials were much gratified as a result of the experiments."

All except the persecuted one presumably.

Automatic Telephone Plant

Maintenance Policy Discussed

THE discussion on the paper "Maintenance Principles for Automatic Telephone Exchange Plant," by Mr. R. W. Palmer, which was presented before the Institution of Electrical Engineers on 10th February (*Electrical Review*, 11th February), was opened by Mr. D. A. Barron (Post Office). He referred to the basis of the subject as the policy of the telephone-operating organization on how good a service it could afford to give, the expenditure on equipment and maintenance and the charges for the service subscribers would put up with. In 1938 the Post Office laid down that routine periodicities should be adjusted to meet prudent necessity. After the war guide figures were introduced to assist people in the field to determine whether they could safely reduce the periodicity of their routine overhauls and testing.

Thinking and timing in this country and America on the maintenance of Strowger equipment were similar. The British Post Office had in the past overdone routine overhaul, some of which had been unnecessary and some perhaps disadvantageous.

Mr. W. H. Grinsted (Siemens) said that manufacturers would much prefer a qualitative maintenance to a routine maintenance policy, provided that the equipment was reliable and the "ambient conditions" in the exchanges satisfactory. Statistics showing failures owing to lack of stability or unreliability in design and to too small margins in the circuit would be very useful. Twin relay contacts had effected such an improvement that precautions formerly taken against contamination by dust and dirt seemed to have been relaxed. An economic case might be made for assessing each item of plant according to its contribution to the service, perhaps in the number of calls handled, so that targets for maintenance expenditure could be allocated on a basis of service rather than plant.

Fault Location

Mr. T. H. Flowers (Post Office) did not agree that it was generally accepted that fault location was easiest with step-by-step systems. Intermittent faults would not be found by functional testers, routiners and route testers except by chance, but they would in time be found by self-testing and automatic monitoring devices. The common control system made fault finding easier than did the step-by-step system. Faults due to normal wear and deterioration would probably start by being intermittent, so that common control systems might be better than individual control.

Mr. T. P. Preist (Automatic Telephone & Electric Co.) criticized the author's definition of a fault as too wide and leaving too much to the personal assessment of the maintenance officer. He would prefer to define a fault as any defect which prevented a circuit or a piece of apparatus from fulfilling its function. A change of condition which prevented the operation of equipment should be classified as a fault, but not one which was merely a departure from some empirical standard adjustment.

His company's experience overseas was that overhauls were worth while only if the overhaul staff was well selected, expertly trained, interested, and had unlimited time. Otherwise they did more harm than good, and frequent functional testing to limits slightly in excess of the exchange requirements was preferable. Laboratory experiments showed that the policy of no overhauls had much to be said for it, and a field experiment by the Post Office on similar lines would be very welcome.

Mr. C. E. Calveley (Post Office) regarded the problem primarily as starting with the higher level of management in allocating the proportions of the total maintenance effort to the floor of the exchange and to analysis and testing. In America far more people were employed on the staff function (in a military sense) than in line organization. The use of electronic equipment bore little relation to the faults experienced. On equipment which had 628,000 calls in 18 months there had been four faults, but on equipment with only 7,400 calls there had been eight faults.

Mr. H. Smart (G.E.C.) questioned the author's statement that many reported mechanical failures ought to be classed as circuit faults because of unreasonable circuit requirements. He suggested that many reported circuit faults were due to unreasonable demands made on circuits by mechanical equipment. Might not some of the apparatus be too good? The subscribers' uniselector, now that it had only 12 steps per call, had a life of two million calls; a cheaper switch might give adequate service.

Mr. S. Rudeforth (Post Office) said that routine work should be at such a rate as to pick up random faults to prevent the service falling below a stipulated standard. With a feedback system which attempted to find the number of routine operations per faulty item, and in turn associated those faulty items with the service given, the rate of routining could be adjusted accordingly and the requisite standard of service maintained at the lowest cost. If all switches were treated alike and overhauled at regular intervals, some would be dealt with unnecessarily and others neglected when they ought to be overhauled.

Mr. W. H. Scarborough (Post Office) suggested that pumping in calls at selected times was the best way to find faults. He therefore favoured qualitative maintenance.

Mr. G. A. Probert asked why, in view of the need for clean air in telephone apparatus rooms, windows which opened were still being put in. He emphasized the importance of accessibility of equipment, mentioning that the lowest row of uniselectors was being placed only 11½in from the floor, so that hundreds of rubber mats had had to be ordered for the engineers to lie on when adjusting them. He felt it might have been wrong to go back from line finders to uniselectors, because the latter towards the end of their life required a great deal of maintenance.

Sir Gordon Radley (Post Office) said that two maintenance policies ran through the paper. One was the traditional policy of prescribing schedules for tests, inspections, overhauls and so on at intervals. The target intervals had recently been adjusted in the light of experience, and the man on the spot given the responsibility to vary those periodicities. The other policy was that of qualitative maintenance. Into which camp was the Post Office going to go? Both were capable of giving equally good results.

The author, in reply, said that in the American Bell system in particular the main function of the staff was to advise and train the foreman grades, and statistics were used to help the foremen to do their job on the exchange floor.

Nuclear Power Stations

Government White Paper Issued

A PROVISIONAL ten-year programme for the building of twelve nuclear power stations with a total capacity of 1,500 to 2,000 MW is outlined in a Government White Paper issued on Tuesday. The cost of the programme is estimated to be £300 million. The electricity produced would equal that from five to six million tons of coal a year, as much heat being extracted from one ton of nuclear fuel as from 10,000 tons of coal. The first reactors will burn uranium, which will produce not only heat but also plutonium. Allowing for the value of the plutonium, the cost of electricity from these power stations should be about 0·6d/kWh—about the same as that from new coal-fired stations.

The stations will be built by private industry for the British Electricity Authority, which will own and operate them. The Atomic Energy Authority, as the only body with the necessary experience, will give technical advice, but will remain primarily a research and development organization, and will design, build and operate pioneering types of reactor. The £300 million quoted does not include expenditure on stations to be completed after 1965, which are not included in the programme under mention. This investment would not be a wholly additional demand on the economy since the nuclear power stations would be built instead of other types of station, on which probably a total of £1,200 million would have been spent in the absence of nuclear power. From 1965 onwards it might be economically desirable to build nuclear instead of coal-burning power stations to meet the annual growth of load. If all went well the total nuclear power station capacity by 1975 could be 10,000 to 15,000 MW with a kWh production rate equivalent to that of 40 million tons of coal. The White Paper makes it clear that, because of the nation's rapidly growing need for power, nuclear energy will supplement and not replace other forms of fuel and that coal mining will " remain one of the major employing industries of the country."

Two Types of Reactor

The experimental nuclear power station now being built at Calder Hall in Cumberland represents this country's first large-scale attempt to produce electricity from this source. During the next ten years two types of reactor are likely to be brought into commercial use. The first—an improved version of the Calder Hall (gas-cooled) type—could come into operation about 1961.

These first reactors will burn only a small proportion of the natural uranium used as fuel but will produce, as well as heat, the valuable element—plutonium. It is pure " fissile " material, whereas only one part in 140 of natural uranium is fissile. The second type of reactor would be liquid-cooled, which by 1965 should be capable of producing more heat from each ton of fuel than the gas-cooled type for the same capital cost.

One possible line of development after 1965 is foreshadowed by existing plans to build a full-scale experimental model of a " fast-breeder " reactor at Dounreay in Caithness, Scotland, which produces more fissile material than it consumes. Another possibility is an " homogeneous " reactor, in which the fissile material is not in the form of solid metal rods, but in some kind of solution or suspension.

Calder Hall is being built at a cost of £15 million to £20 million, which could be reduced with improved reactors of the same type for new stations having outputs of from 100 to 200 MW. Fuel cost depends on cost of raw materials and its processing and the heat obtained from each ton. The cost of the initial charge of fabricated uranium for a station similar to Calder Hall may amount to about £5 million and would need renewal every three to five years. The cost of processing uranium, both before and after use, is known from the military programme at the Springfields and Windscale factories. The provisional programme is as follows:—

	Construction Begins.	In Operation.
(a) Two gas-cooled stations (two reactors each)	Mid-1957	1960-61
(b) Two gas-cooled stations (two reactors each). Improved type	1958-59	1963
Total output from four stations: 400 to 800 MW.		
(c) Four stations (gas-cooled?). Probably one reactor each but of higher rating	1960	1963-64
(d) Four stations (liquid-cooled?). Probably one higher-rated reactor each	1961-62	1965
Total installed capacity of eight stations: Well over 1,000 MW.		

Probable Rate of Progress

By the end of the ten years this country would probably need new generating capacity at the rate of over 2,000 MW a year. The new nuclear stations coming into operation each year would be meeting about a quarter of this and the proportion would rise rapidly thereafter. Plutonium from the early reactors should begin to become available in 1964 for enriching the fuel charges in later, probably liquid-cooled, reactors.

An " atomic explosion " cannot take place in a power reactor. Reactors for the commercial production of electricity will present no more danger to operatives or to people living nearby than many existing industrial works. Nevertheless the first stations, even though inherently safe, will not be built in heavily built-up areas. The problem of the disposal of radioactive waste, small in volume, is primarily one for a few chemical processing plants and not for the power stations. A great part of it can be usefully employed. Any material discharged will be tested to ensure that its radioactivity will be comparable in effect to the ever-present natural background radioactivity.

The experience gained by British industry in designing and building nuclear power stations during the next ten years should lay the foundations for the building up of a valuable export trade.

INDUSTRIAL NEWS

National Research Development Corporation

The annual report and statement of accounts of the National Research Development Corporation for the year 1953-54 has been submitted to the Board of Trade in accordance with the Development of Inventions Act, 1948, and is available from H.M. Stationery Office, price 9d.

During the year electronic digital computers continued to be the Corporation's largest single project. Six big computers of the Manchester University type have been ordered, of which five have been sold and will be delivered during this year. Tape recorders for use in conjunction with computers have also been ordered to a design based on that of the Mathematical Laboratory, Cambridge. Other work was concerned with the Ricardo light steam engine, a regenerative mechanical transmission system, a photogrammetric plotting instrument and Merton diffraction gratings. Among new projects started during the year was one on a stereoscopic ciné camera and another on printed electrical circuits.

The report shows that 664 inventions were communicated to the Corporation during the year and that the rights in 375 U.K. patents and applications were formally assigned to the Corporation. This now makes the Corporation the owner of 2,647 U.K. and overseas patents and applications which it administers. Of the 272 licence agreements which are in force with industry, 99 are revenue earning, the receipts therefrom during the year amounting to £27,650.

New G.E.C. Traction Works

To augment its manufacturing facilities for electric traction the General Electric Co., Ltd., has purchased a works at Dudley Port, Staffs, which will be devoted exclusively to the manufacture of motors, generators and auxiliary machines for electric and diesel-electric locomotives and rolling stock. The new premises will provide an additional 100,000 sq ft of factory space, and enable the company to play its full part in meeting the big demand which must arise from the important development of British Railways proposed for the next twelve years.

The new works is situated within easy reach of the company's engineering works at Witton, Birmingham, from which it will be controlled. It will form a self-contained manufacturing unit handling all processes from the raw material stage to the final assembly, testing and despatch of the machines. Flow-line methods representing the most up-to-date production practice will be adopted, and the works, which will be in full production within twelve months, will have a potential output of over £1,000,000 of equipment a year.

E.T.U. Members Fined

The *Daily Telegraph* reports that three members of the Electrical Trades Union have been fined sums ranging from £5 to £20 by the Union for leading a return to work after a strike at J. Lyons & Co.'s Cadby Hall establishment last year. Certain other penalties have been imposed. It is stated that 140 men who returned to work without the Union's permission have also been notified that disciplinary action is pending against them.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £163 0s 0d
COPPER, H.C. Electro	ton £353 15s 0d
Fire Refined 99·70%	ton £351 0s 0d
Fire Refined 99·50%	ton £350 0s 0d
COPPER Tubes ..	lb 3s 9½d
Sheet	ton £423 5s 0d
H.C. wire and strip ..	ton £401 15s 0d
LEAD, English ..	ton £102 15s 0d
Foreign	ton £101 0s 0d
MERCURY	flask £109 0s 0d
TIN, block (English) ..	ton £713 10s 0d
ZINC, G.O.B. Foreign	ton £91 0s 0d
Electrolytic	ton £97 10s 0d
BRASS Tubes (solid drawn)	lb 2s 8½d
Sheet	ton £331 5s 0d
Wire	lb 3s 3½d
PHOSPHOR BRONZE Wire	lb 4s 10½d
PLATINUM	oz £29 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 30½d—30⅞d

Italian Underground Railway

The first underground railway in Italy, the Metropolitana, which extends southwards from the main railway station of Rome for a distance of seven miles, was officially inaugurated last week by the President of the Republic.

Scottish Dairy Show

In our note in last week's issue we referred to the joint display by the Electrical Development Association and the South East Scotland Electricity Board at the Scottish Dairy Show. This should have read the *South West* Scotland Electricity Board.

Industrial Charges Reduced

The North Western Electricity Board has announced that over 3,500 large industrial and commercial firms in the area will benefit from a decision to pass on to these consumers certain reductions in the tariff charged to the Board by the British Electricity Authority. This reduction will commence from 1st April, and will benefit the consumers concerned to the extent of about £61,000 per annum. It will be recalled that in April of last year the Board made reductions amounting to £63,000 per annum in charges to industrial consumers, although the revision of the bulk supply tariff announced at that time represented an additional cost to the Board of some £335,000 per annum.

Arora Business Purchased

Electroway Heaters, Ltd., Loughborough, have purchased the factory and business of the Arora Co., Loughborough, with effect from 25th March. The Arora Co. will in the meantime continue to fulfil outstanding orders, after which they will be undertaken by Electroway Heaters, Ltd.

E.W.F. Annual Meeting

The Electrical Wholesalers Federation tells us that its annual general meeting is to be held on 17th March at the Dorchester Hotel and not at the Waldorf Hotel as previously notified. The Federation's annual dinner in the evening will be at the Dorchester Hotel as already announced. Sir W. Wavell Wakefield, M.P., will be the principal guest.

Swiss Electrical Industry

Output, inflow of orders and employment in the Swiss electrical machinery and equipment industry last year remained at the high level reached in 1953, states the annual survey of economic conditions in Switzerland published by the Credit Suisse of Zurich. Electrical exports in the first ten months of 1954 aggregated 249 million Swiss francs; this was 1·4 per cent above the record value established in 1951 and 6½ per cent more than in the corresponding period of 1953. Compared with the latter figure, the increase in the weight of goods exported over the 1953 total was no less than 15·7 per cent. More detailed figures show that in the January to October period the weight of exports of electrical machinery and transformers exceeded the 1953 figure by 22·3 per cent and the value was up by 16·2 per cent.

The relatively more marked increase in quantities exported reflects a decline in prices brought about by the more intense competition in spite of the well-maintained demand. Apart from price, quality and terms of delivery, the method of payment is nowadays playing a decisive part in export trade, customers requiring not merely

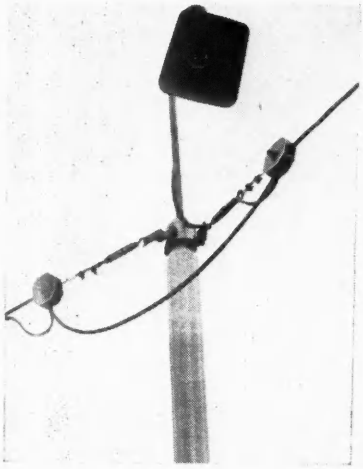
extensive credit facilities but often complete financing by the supplier.

Business in the home market developed very favourably, thanks to the progressive expansion of the Swiss electricity supply system. Manufacturers of heavy electrical machinery report a high level of employment and a satisfactory influx of orders. Because of the expansion of productive capacity, work in hand has declined somewhat as compared with the situation obtaining during 1953 and the industry is now able to offer shorter delivery terms.

Football Ground Installation

At the Brentford Football Club's ground at Griffin Park, where a floodlighting system has recently been installed, it was necessary also to provide amenity and approach lighting amounting to some 250 lighting points, with a total load exceeding 30 kW. The Enfield "Grid Suspension" wiring system was chosen to provide the basis of the distribution and some 1,500 yd of 3/·036in twin and four-core cable was installed.

For the general lighting of the stands, spans of up to 450ft were erected, anchored at the ends and supported intermediately from the trusses of the roof structure. Subsequent to the erection of the cable, intermediate connection boxes of a special type were inserted in the cable runs, from which were taken the connections to the lighting fittings. The



Method of connection to street lighting standard at the east entrance of the Griffin Park, Brentford, football ground

latter were not, in this case, suspended from the cable, but from the roof trusses, as it was decided that undue movement of them would result had they been so suspended.

The lighting of the entrances and approaches was similarly dealt with, except that in this case the connections from the various lighting fittings were wired in p.v.c. sheathed cables attached to the structure and connected in groups to the previously mentioned special connection boxes. Groups of up to five cables were dealt with. At the east entrance to the uncovered terrace no attachment to a structure was possible, so that the catenary cables were suspended between the street lighting standards used for the support of the floodlighting fittings.

The installation work was carried out by F. C. Ward & Son (Electrical), Ltd., as electrical sub-contractors to the main contractors, J. J. Sawyer, Ltd.

E.C.A. Conference

The annual conference of the Electrical Contractors' Association and allied associations will be held at Margate from Sunday, 5th June, to Tuesday, 7th June. Registration will take place on the Sunday and the business sessions will be held on the following days.

Arc Welding and Fabrication

An exhibition of arc welding and fabrication equipment is being held in conjunction with Petbow, Ltd., in the Midlands Electricity Board's Industrial Showroom at 247, Chester Street, Aston, Birmingham, 6, until 25th February. The exhibition is open on Monday to Friday inclusive from 10 a.m. to noon and 2 p.m. to 4.30 p.m. A wide range of welding, cutting and manipulating equipment is being displayed and demonstrated.

P.F. Ash for Aden Harbour Works

Pulverized fuel ash from the British Electricity Authority's power station at Littlebrook (Dartford) is being shipped to Aden for the new harbour works. The initial contract is for 1,450 tons to be used as a partial replacement of cement in the concrete works. The contractors are Pauling & Co., Ltd., and the consulting engineers are Sir Bruce White, Wolf Barry & Partners who decided to specify this material after careful consideration of its characteristics. It is expected that this initial order for Aden will lead to other markets abroad, as a well-known shipping company is exploring for the Authority the possibilities in many overseas countries.

The use of pulverized fuel ash in concrete works is well known in the United States and is growing in this country. It also has other uses, notably in brick making and as a sintered light-weight aggregate. The B.E.A. has recently appointed, in its Commercial Department, an ash marketing officer to propagate still further the work that has been done with this hitherto waste material.

Easy Switchboard Assembly

A range of low voltage switchgear offering space-saving facilities and a simple method of switchboard construction for contractors wishing to build their own, was demonstrated by Dorman & Smith, Ltd., in London last week. A 300 A incoming switch-fuse, a busbar chamber, one 150 A and two 30 A outgoing switch-fuses, together with associated supports, braces, and connections, were assembled from scratch by two men in a period of about an hour. The equipment was from the company's "TS" range and the switches all had their operating handles at the front instead of the side, permitting their being mounted close to one another.

New Pressed Steel Co. Factory

Work has begun at Stratton St. Margaret, Swindon, on a new factory for the Pressed Steel Co., Ltd., of Oxford. The first stage of the new factory is estimated to cost £1,000,000. Speaking last week at a ceremony to mark the beginning of work on the scheme, Mr. M. A. H. Bellhouse, deputy managing director, said that after its present building schemes had been completed all future development by the company would take place at Stratton St. Margaret.

Industrial Truck Safety Code

With the widening use of industrial power trucks and mechanical handling methods, the Industrial Truck Manufacturers' Association has issued a comprehensive "Safety Code for Industrial Power Trucks," which covers the safe design and use of equipment. The booklet is divided into six parts, viz.:—Construction and design considerations; minimum capacity ratings; operation of equipment; safety code for straddle carriers; nomenclature; and operators' safety rules and regulations. In the last mentioned section, humorous drawings give point to the text. Copies of the booklet can be obtained from the Association, 94-98, Petty France, London, S.W.1, price 2s 6d, post free.

Edmundsons Reunion

The annual reunion of employees of the former Edmundsons Group of electricity undertakings will be held on 29th April at the Horseshoe Hotel, Tottenham Court Road, W.1, at 6 for 7.30 p.m. Tickets (17s 6d each) can be obtained from Mr. F. T. Scribens, Room 425, British Electricity Authority, Winsley Street, London, W.1, or from Mr. R. H. Sharman, Room 212, B.E.A., Bankside House, Sumner Street, London, S.E.1. Mr. D. H. Kendon, chairman of the Merseyside and North Wales Electricity Board, has accepted an invitation to be chairman of the Group for 1955.

"Research" Essay Competition

The Scientific Advisory Board of *Research* (chairman, Lord Waverley), 436, Strand, London, W.C.2, has decided to organize a third "Science in Industry" Essay Competition, to encourage scientists to take greater interest in the problem of presenting the results of scientific research work to people less highly qualified than themselves.

The competition is in two parts. In

the first part competitors are required to make a case in an essay about 3,000 words long for the development or investigation of some new scientific process or project in terms which a technically unqualified industrial board can appreciate. Prizes amounting to £200 are to be awarded for this part of the competition and, in addition, the author of the best essay will receive a new award, the Waverley Gold Medal.

The second part requires the scientist to discuss one of four set subjects in a manner suitable for publication in a general newspaper. Prizes amounting to £150 are to be awarded by the *Sunday Times*.

Canadian Power Show

Canada's Power Show, sponsored by the Institute of Power Engineers, will be held from 8th to 11th November next in the Show Mart Building, Montreal. The Show covers the whole range of products connected with the power industry. Displays will include exhibits of valves, steam traps, strainers and temperature regulators, compressors, engines and motors. In addition to the exhibition there will be technical sessions, panel discussions, lectures and technical films.

United Kingdom firms interested in having their agents display their goods at this exhibition should ask them to write to the general secretary, Institute of Power Engineers, 410, Bloor Street East, Toronto, 5. The Exhibitions and Fairs Branch of the Board of Trade, Lacon House, Theobalds Road, London, W.C.1 (telephone: Chancery 4411, extension 436), will answer inquiries and lend a copy of the brochure. Reference E & F 736/54 should be quoted.

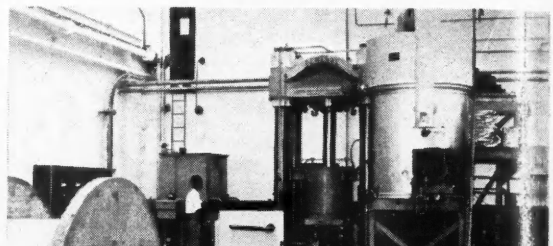
Television Society Dinner

The annual dinner of the Television Society will be held at the Dorchester Hotel on Tuesday, 22nd March, and *not* on Friday, 18th March, as previously announced. The guest of honour will be Sir George Barnes, director of B.B.C. Television, and the guests will be received by the president of the Society, Sir Vincent de Ferranti. A limited number of tickets are available to non-members (price 2 gns each). Applications for these should be made to the secretary at 164, Shaftesbury Avenue, W.C.2.

Telephone Cable Factory in India

A telephone cable factory with an initial capacity of about 500 miles of cables annually commenced production for the first time in India in December when the West Bengal Chief Minister inaugurated the Hindustan Cables, Ltd., at Rupnarainpur, near Chittaranjan, about 145 miles north-west of Calcutta in the industrial belt of the Damodar Valley. The plant, which has been set up in co-operation with Standard Telephone & Cables, Ltd., of London, has cost so far just over a million pounds and is equipped for manufacturing local or exchange area cables, long distance audio frequency trunk cables and carrier frequency cables. It will for the present concentrate on local or exchange area cables only and then gradually take up the other types.

Annual production will be worth over a crore of rupees (£750,000), about two-thirds of the country's present requirements. It is understood that these cables will cost 25 per cent less than the imported article. Of the necessary raw materials, copper wire, hessian and timber will be mainly from indigenous sources, while steel tape, insulating paper and lead will be imported from abroad. The Posts and Telegraphs Department is spending about £8 million in the current five-year plan, most of it on trunk cables which are now imported. The factory will commence the manufacture of these coaxial cables as soon as the necessary machinery for which provision has been made is installed. The plant will be taking power from the Damodar Valley Corporation's grid.



Lead covering of telephone cables at the Hindustan Cables factory at Rupnarainpur, Bengal

The 1955 "Minibition"

The Purchasing Officers Association is holding its sixth "Minibition" at the Winter Gardens, Cliftonville, from 29th September to 1st October next, in conjunction with its 1955 National Conference. Although there will be room for more stands at Cliftonville than is usually the case, already most of the available space has been reserved.

E.A.W. Housecraft Examinations

The latest certificate examination of the E.A.W. in electrical housecraft for demonstrators and saleswomen was held on 9th December, when 63 candidates qualified for the certificate, two gaining distinction. The total number of certificate holders is now 2,217.

In the certificate examination for teachers held on 11th December forty candidates qualified for the certificate, two gaining distinction, making the total number of certificate holders 1,957.

Trade Announcements

Pye Telecommunications, Ltd., has appointed Mr. F. H. Foster as area sales manager for Derbyshire, Nottinghamshire, Lincoln and Lindsey, and Sheffield. He will be operating from Sheffield and his address is 348, St. James's Chambers, 56, Church Street, Sheffield.

The Ransome & Marles Bearing Co., Ltd., has opened a new branch office in Scotland and has also moved to larger premises in Leeds. In Dundee, Angus, the new office at 310, Perth Road (telephone: Dundee 66155), is under the control of Mr. F. W. Austin. The branch office in Leeds is now at St. Paul's House, 20-22, St. Paul's Street, Leeds, 1 (telephone: Leeds 32094/5), where Mr. J. R. Robertson is the manager.

Nettle Accessories, Ltd., Harper Road, Wythenshawe, Manchester.—The telephone number has been changed to Wythenshawe 4321.

T. D. Young & Sons, Ltd., electrical and radio wholesalers.—The registered office is now at 100, North Sherwood Street, Nottingham (telephone: Nottingham 47641/2), to which address all communications should be sent.

J. E. Baty & Co., Ltd., have appointed Mr. J. Hews, 57, Arnold Avenue, Coventry, as their Midlands representative.

The **Clare Instrument Company** has moved to 8, South Street, West Worthing (telephone: Worthing 3407). Sales matters will continue to be dealt with at the London office, 39, Victoria Street, S.W.1 (telephone: Abbey 1816).

Damages Award

A case which counsel said "would have been of interest to lawyers to argue" was settled at Chester Assizes last week when Mrs. Agnes May Williams, of Alexandra Road, Wrexham, was awarded £4,000 damages against the Merseyside and North Wales Electricity Board. Approving the settlement, Mr. Justice Finnemore apportioned £350 to Mrs. Williams' 17-year-old son. He gave judgment with costs against the Board. Judgment against Mrs. Williams was given to a second defendant, the Rossett Sand & Gravel Co., Ltd., who were

also given judgment against the Board in third party proceedings, and were awarded all their costs against the Board.

Mr. David Pennant, for Mrs. Williams, said that her husband, Philip Johnson Williams, who was employed as a linesman by the Board, and a Board foreman were both killed by electric shock in an open-air transformer compound. "Apparently, in a moment of perhaps excessive zeal, the foreman opened the unclimbable fence so that they could cut the grass in the compound," he said.

Electrical Exports to Russia

In an article on trade with the Soviet Union and other Eastern European countries the *Board of Trade Journal* shows that the 1936-38 annual average of exports of electrical machinery from this country to Russia was 197 tons valued at £44,000. The figure rose to 1,484 tons (£594,000) in 1952 then fell to 213 tons (£179,000) in 1953; in the first eleven months of 1954 these exports totalled 2,362 tons valued at £1,443,000.

Electrical machinery exports to other Eastern European countries (including the Eastern Zone of Germany) are given as 18,113 cwt (£155,000) in 1952; 17,577 cwt (£787,000) in 1953; and 16,573 cwt (£438,000) in the first eleven months of 1954. The 1936-38 value is shown as £155,000.

Copper Wire Rods Import Quota

The Board of Trade announces that a quota of 7,500 tons per annum has been established for the import of black hot rolled copper wire rods from Canada and the United States during the year beginning 1st April next. The quota will be allocated in two half-yearly instalments. Agents of North American producers of rods and wire drawers in the United Kingdom are invited to apply for licences to import during the first period and applications should be submitted on form ILB/A to the Import Licensing Branch of the Board of Trade, 43, Marsham Street, London, S.W.1, not later than 1st March.

Exchanging Experience

During the past eighteen months about 7,000 inter-factory visits have been made under the Circuit Scheme instituted by the British Productivity Council, 21, Tothill Street, London, S.W.1. The firms concerned represent a cross-section of industry by size and product and in the areas in which they operate. The scheme provides for a regular interchange of visits between six or eight neighbouring firms which agree to constitute a "circuit." The visits are made by small selected teams on which management, technicians and operatives are represented. The primary purpose is to exchange information about machines, methods and ideas which have been effective in raising productivity.

A supplement to the "B.P.C. Bulletin" for January contains an interim report upon the operation of the scheme, indicating the way in which teams go about their work and mentioning some of the results which have been achieved.

Papers on Welding

The Council of the Institute of Welding announces that papers to be considered for the award of the Sir William J. Larke Medal of the Institute for 1955 must reach the secretary at the Institute's offices, 2, Buckingham Palace Gardens, London, S.W.1, not later than 30th April. Particulars of the regulations for the award of the Medal, for which non-members as well as members of the Institute may compete, may be had from the same address.

Aluminium Billet Heating Furnace

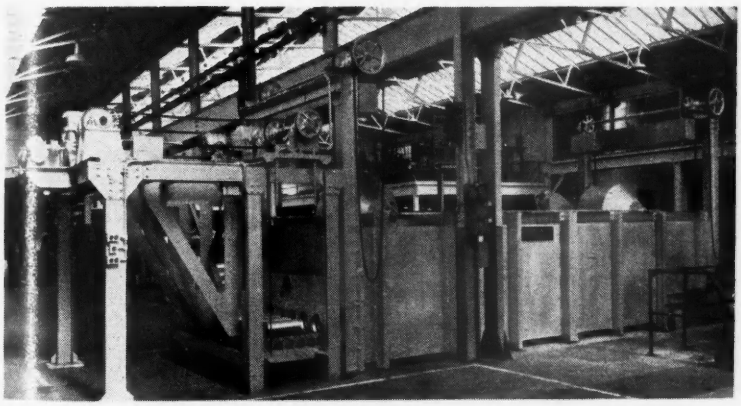
NEW plant for the aluminium sheathing of cable has recently been installed at their Prescot works by British Insulated Callender's Cables, Ltd. The specially designed hydraulic press was ordered from the Loewy Engineering Co., Ltd., who also contracted to supply a suitable billet heating furnace to feed this press. The furnace selected was an electrically heated unit designed and installed by G. W. B. Furnaces, Ltd.

The sheathing of the cable in the Loewy press involves the use of two billets, these being charged at the two ends of the horizontal container. The billets are extruded into the tube through the core and die tools positioned mid-way along the length of the container and at right angles to the latter. The temperature of the billets supplied to the press is critical, as there must be equal deformation of these and also complete welding in the course of extrusion, in order to obtain a satisfactory product. The billet temperature required for sheathing direct on to some types of cable core is of the order of 300 deg C or less, but the equipment may also be operated at temperatures up to 450 deg C for other production purposes. The working range required on the furnace thus extends from less than 300 deg C to a maximum of 450 deg C.

The furnace has an internal chamber 20ft long by 1ft 3in high, and 6 rows of "diabolo" shaped idler rollers are fitted in the hearth. The charge varies from aluminium billets of 6·5in diameter by 12in long and up to 9in diameter by 18in long, and the maximum output for which the unit has been designed is 1,680 lb/hr at 450 deg C. The total rating of 165 kW is divided into two automatically controlled zones, and spread evenly over the three-phase mains supply. Zone 1, where the initial heating of the billets takes place, is rated at 105 kW, both zones being 10ft long.

Since the Loewy press requires two billets for sheathing the cable, the automatic discharge mechanism of the furnace is arranged to provide two billets at a time, heated to the correct extrusion temperature. The short end sections of the idler roller rows are arranged to incline, so that the billets roll out under gravity. An electrically operated combined pusher gear and hoist is situated at the charging end of the furnace, while adjustable stops permit varying lengths of billet to be catered for. Temperature control is effected by means of two Foster automatic indicating controllers, one for each zone, while a two-point recording instrument gives a positive check on thermal conditions along the length of the heating chamber. This recorder is fitted with excess temperature safety contacts to protect the unit and the charge against accidental overheating.

Electrically heated furnace for aluminium billets at the B.I.C.C. Prescot works



GENERATION AND DEVELOPMENT

Revised Industrial Charges

The Eastern Electricity Board, which last month gave particulars of proposed revisions of the domestic, combined premises, farm and block tariffs necessitated by higher costs, announced this week that it had now fixed the terms of the new maximum demand tariff to come into force on 1st April.

Under the terms of the new m.d. tariff, which generally applies to the large industrial users, consumers will pay 6d a month more than under the existing tariff for each kW or kVA of maximum demand. The cost of fuel adjustment figures in the new tariff will be less than previously, however, because of a similar reduction to the Board in the terms on which it buys its bulk supply from the British Electricity Authority. For most consumers taking a supply on this tariff the net result of these two changes will be only a small alteration within the range of 3 per cent increase to ¼ per cent decrease in their total bill.

Kent Power Station Site

The reported proposal of the British Electricity Authority to erect a power station at Richborough in Kent was referred to at a recent meeting of the Ramsgate Town Council. The county planning officer, in a letter to the Council, said that the area of land the Authority would need, if the routine ground-proving tests were satisfactory, lay partly within the borough. Work on the station was to be started in 1957 and it would probably be in operation by 1961.

Power Station Inquiry

When a Ministry of Fuel and Power inquiry was held at Bedlington (Northumberland) into the scheme by the British Electricity Authority to erect a £30 million power station between Bedlington and Blyth, it was stated that the main opposition to the proposal related to the method of disposing of ash. The inquiry, which lasted eight hours, was conducted by Mr. H. W. Grimmitt, the Ministry's chief engineering inspector.

Mr. G. A. Thesiger, Q.C., outlining the scheme, said the new power station was urgently needed and it had been extremely difficult to find a suitable site in the North-East. The B.E.A. had investigated the possibility of building at Newbiggin or Whitley Bay, but had decided that the site selected at Cambois, between Blyth and Bedlington, was the best. It had been intended to dispose of ash by carrying it out to sea in barges for dumping. Some objectors had contended that this method would cause a nuisance, and it had therefore been decided to adopt a system of discharging the ash, which Mr. Thesiger described as "silvery-grey sand," through an aqueduct straight into the sea. The Northumberland County Council and the Blyth, Sunderland, South Shields and Whitley Bay Councils preferred dumping at sea from barges, however. The Northumberland Sea Fisheries Committee and the Tyneside and Northumberland River Board were also against the sluicing method.

Mr. Donald Clark, B.E.A. station development engineer, said that intense combustion would prevent the issue of black smoke. There would be two 450ft high chimneys and as a result there would be no concentration of sulphur at ground level. The discharge from the chimneys would be carried well out to sea by off-shore winds. Ash sluiced out to sea would sink to the sea bottom as its specific gravity was nearly twice that of the water.

Powers of Consultative Councils

Consultative Councils should either be given more authority or they should be abolished. This view was expressed by Alderman J. W. Holland, vice-chairman, at the quarterly meeting of the Yorkshire Electricity Consultative Council at Leeds last week. He said the Councils were being frustrated in their efforts to represent consumers and were increasingly being looked upon with disdain. There had been a tendency on the part of the officials of the Yorkshire Board "not to look with approbation" on the Council. Although the Council had always received courtesy from the Board it had taken a long time to get a good deal of information asked for. There had been a disagreement on the new domestic tariff and the Council had taken the matter to the B.E.A., but the chairman of the Board was also a member of the Authority. Furthermore, the Minister, whom the Council had the right to approach, was advised by his permanent officials who were in day to day contact with the chairman of the B.E.A.

Assessment of Unwired Rooms

The Yorkshire Electricity Consultative Council has expressed the opinion that it would be fairer to consumers if unwired rooms were not counted as assessable for the purpose of the domestic tariff.

Northern Ireland Power Plans

In the Queen's Speech which was read by the Governor (Lord Wakehurst) at last week's opening of a new session of the Northern Ireland Parliament it was stated that two schemes for hydro-electric development were being examined and the Government had approved the construction of a large generating station on a site to be selected outside Belfast. The Speech added: "The highest importance is attached to the benefits that may result from the application of atomic energy to industrial uses and, in particular, to the generation of electricity. Arrangements have been made to ensure that full advantage can be taken of the developments now proceeding in Great Britain as soon as these reach a point where they may profitably be applied in Northern Ireland."

Private Power Plant

A power station costing several million pounds and occupying between 10 and 12 acres is to be built by Imperial Chemical Industries at Thornton, near Fleetwood, Lancashire, to supply three large I.C.I. works in the area.

East Yelland Inauguration

Arrangements are being made for the official opening, on Thursday, 21st April, of the East Yelland generating station, North Devon. The opening ceremony is to be performed by the Lord Lieutenant of Devon (Earl Fortescue, K.C.B.) and Lord Citrine (chairman of the B.E.A.) will be present. The station's ultimate capacity will be 180 MW; at present 90 MW is installed.

Importance of Domestic Load

Unless tenants on new housing estates in Yorkshire use more electrical appliances and people generally install more cookers and heaters, the price of electricity must inevitably rise, according to an official of the Yorkshire Electricity Board. Replying to recent criticism of the Board's approaches to various local authorities for certain trading facilities, he pointed out that the cost of supplying electricity to a house to-day was £60, compared with £20 before the war. The Board had been combating rising prices by greater efficiency and would be greatly helped if consumers installed more equipment. That was why the Board had asked Doncaster Rural District Council to provide it with the names of people who were soon to get houses. The Board did not want to do the wiring; it wanted to ensure that there were adequate installations.

Canadian Atomic Power Plan

According to the Toronto correspondent of *The Times*, Mr. W. J. Bennett, president of Atomic Energy of Canada, Ltd., stated last week that an atomic power station was to be built in Canada, possibly in Southern Ontario. It was expected to be producing power early in 1958.

Glasgow Tramway Conversion

Conversion of ten tram routes in Glasgow, eight to motor-bus and two to trolley-bus operation, is recommended by the transport manager Mr. E. R. L. Fitzpayne.

A.C. Colliery Winding

FOR the modernization of the winding plant at Avon Colliery, Blaengwynfi, South Wales, the General Electric Co., Ltd., was commissioned to supply and install a complete electrically-driven winding engine to replace the existing steam engine. The contract covered a 1,100 h.p., 3·3 kV, 475 r.p.m. slip-ring motor with its associated control gear and the supply of a new parallel winder drum, 12ft in diameter and 8ft wide, built at the company's Erith works.

With a depth of wind of 1,575ft the plant is designed to raise approximately three tons of coal or five and a half tons of stone per wind, the winding cycle being: Acceleration, 10 sec.; full speed 36·3 sec.; deceleration, 10 sec.; and decking, 20 sec. This represents about 47 winds an hour giving an hourly output of some 140 tons of coal.

This installation is of particular interest since it is the first a.c. winder in this country to use the new G.E.C. system of dynamic braking and speed control, the operation of which, as far as the driver is concerned, approaches closely that long established for d.c. equipments using Ward-Leonard control with overriding current limitation.

Some months before the change-over, which was scheduled for the annual holiday fortnight, the roof of the engine house was removed and the height of the side walls increased. Lifting girders to deal with the dismantling of the old steam engine and the erection of the new winder were installed and fitted with runner blocks. The foundation for the motor in an adjacent annexe was constructed in such a manner that it could be finally joined to the foundation of the new engine.

To assist in the preparation of the planned schedule, a large scale model was made of the existing engine foundation and this was sectionalized to show the amount of masonry to be demolished. Models were made of the new foundations and these fitted accurately into the spaces indicating removed masonry. The whole model could be dismantled and re-assembled to indicate all the demolition and construction work. The new engine room floor and carrying girders together with all foundation bolt holes were indicated on a sheet of " Perspex."

This model was extremely useful in as much as it was a check on all the drawing dimensions, and the amount of concrete to be used; and also that it gave a very clear picture of the work involved to all persons connected with the actual operation of carrying out the scheme. Since access to the engine house at Avon Colliery was difficult all the components of the new engine were placed on trolleys in correct sequence for erection.

The colliery closed down on the Friday night and the dismantling of the steam engine was completed by Sunday evening. The larger parts were withdrawn from the engine house on trolleys and dropped over a retaining wall so that they were ready for loading away into railway wagons on the adjacent sidings.

To make room for the controller in the basement of the engine house, a considerable section of the existing foundations had to be removed and in order to do this it was necessary to resort to the use of explosives—the debris being cleared from the winding engine house basement by means of a scraper chain conveyor.

Five and a half days after beginning the job the new foundations and part of the new floor of the engine house were completed and erection of the new winder began; the whole work having been completed in accordance with the planned time schedule.

Once erection of the winder was under way, it was clear that the prior planning by National Coal Board engineers was working out exactly and it is to their credit that the arrangements and planning before the change-over saved considerable time and enabled the pit to reopen for the first shift after the annual holiday shut-down.

The new G.E.C. dynamic braking and control system with speed control features is a further development of a similar scheme installed for four 4,200 h.p. a.c. winders in the Orange Free State goldfields. For this installation the system was designed to give accurate torque control and this, with the additional feature of speed control, gives a direct relationship between the steady rope speed and the position of the driver's lever.

The winding plant at Avon Colliery

Servo-Mechanisms

AN introduction to the study of servo-mechanisms was the subject of a Students' Premium paper by Mr. P. J. Bhatt, which was presented before the Utilization Section of the Institution of Electrical Engineers on 17th February. " Servo-mechanisms " was defined as an automatic self-operated system that regulated an output quantity.

A typical supervisory or open control system consisted essentially of a separately excited generator supplying power to an electric motor driving a load. A resistance in the exciter field was set to give the required motor speed or generator voltage at a certain load, any variation from which necessitated resetting the rheostat. For predicted or predetermined periodic variations in speed or voltage, adjustments could be made by a timing unit or a cam, giving a semi-automatic system.

Where the variations were unpredictable the automatic system must be supplied with information about the desired area actual states. If these states differed, the system must be capable of using the error to make the necessary compensation. In one arrangement the resistance comprised a carbon pile regulator controlled by a coil energized by a current proportional to the motor speed or generator voltage. The force exerted by the coil was opposed by a spring tension, the difference creating a force which changed the resistance to correct the difference.

The subject was developed in the paper mathematically to cover elaborate instances of the use of the system. These included the tracing of a chain of action and methods of simplifying the procedure and the determination of the response of a system to an oscillatory input, from which its behaviour under any non-sinusoidal variation, expressed as a function of time, could be readily ascertained. The circumstances in which self-sustained oscillations were set up (hunting), making the system unstable, were explained in detail. On a d.c. system the effect of hunting would be similar to that of a superimposed a.c. component. In some cases the d.c. component could be removed without affecting the a.c. On a.c. equipment hunting could occur independently of the normal currents and at a different frequency.

Reference was made to a list of empirical guides to relative stability based on a " standard " performance (A. L. Whitely, 1946), with which the characteristic equation of a system could be compared; if the coefficient were larger, the maximum overshoot was less than that of the standard. Although trial and error methods were still required, a trend and satisfactory response could be arrived at with less labour.

Financial Section

STOCKS and SHARES

STOCK EXCHANGE movements could scarcely be anything but variable for the time being. Apart from the latest political developments overseas, the slowness of sterling to respond to last month's ½ per cent rise in Bank Rate keeps alive the possibility of another taste of the same medicine. Mr. Butler's comments on the rising tendency for British imports to outstrip the pace of exports also made for caution. Electrical equipment shares continue to behave better than many others, thanks largely to buying on the strength of the railway electrification and development plans. Several shares with electronic associations remain in high favour. New issue activity is being increased substantially by large-scale capital operations on the part of G.E.C. and E.M.I.

Mixed Movements

English Electrics and A.E.I. each added 1s 3d to previous rises initiated by the £1,200 million railway projects. Lancashire Dynamos and Crabtree Electricals improved to the same extent, while Reyrolles gained yet another half-crown. Automatic Telephones advanced by 2s 6d. Arons were conspicuous in putting on 4s 9d. Other firm spots were Switchgear & Cowans, Bakelite and Laurence Scott. On the other hand, some of the cable manufacturers' shares lost a little of their recent strength, and there were moderate reactions in S. Smith, Chloride Electrics, Brush, Ekco and Cable & Wireless.

G.E.C. Financing

General Electric £1 shares moved a little uncertainly, following news of the company's big finance proposals, but on balance were little changed. Some £10½ million is being raised, for the further expansion of the group's activities, through the offer of £6 million 4 per cent unsecured loan stock 1975-80 to all classes of stockholders, at a price of 97½, and of a little under 2 million new £1 ordinary shares to existing holders, at 48s per share. Applicants for the loan stock must put up £10 per cent initially, the balance not being due until July. At the time of the announcement, the terms on which this stock is being offered, when set against the position of comparable issues already in the market, were regarded in the market as favourable.

Ordinary stockholders of G.E.C. are being offered the new £1 shares in the proportion of one new share at 48s for every six held. Regarding dividend prospects, the company had already indicated a total of 12½ per cent (of which 4½ per cent has already been declared as an interim) for the current year, which ends in March, and now confirms that the expected 8 per cent final payment will apply to the capital as increased by this issue. Allowing, therefore, for the deduction of the value of the rights from the price, the prospective yield on the shares is a

Week's Price Changes

Company or Board	Nom. Value	Middle price 14th Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
						£ s d		
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	91½		3	3	—	97	88⅞
Brit. Elec. 1974/77	100	89½xd		3	3	3 5 7	96½	87½
Brit. Elec 1976/79	100	96½		3½	3½	3 12 5	101½	93 3/16
Brit. Elec. 1974/79	100	106½		4¼	4¼	3 19 10	111⅜	103 3/16
Overseas Electric Supply								
Calcutta Elec.	£1	21/-	−6d	6†	6†	5 14 3†	24/6	18/7
East African Power	£1	21/6	−1/-	7	7	6 8 9	23/4	19/6
Nigerian Elec.	£1	25/6		10	10	7 17 0	25/-	23/6
Palestine Elec. "A"	£1	22/-		Nil	Nil	—	21/-	16/-
Perak Hydro-Elec.	£1	18/6	−6d	6	10	10 16 3	20/-	13/9
Equipment and Manufacturing								
Aberdare Cables	5/-	13/3		25	12½*	4 14 3	14/3	8/1
Aerialite	1/-	6/3		88½	88½	7 1 6	14/6	10/9
Allen. W. H.	£1	79/6		15	20	5 0 8	78/6	50/-
Aron Elec. Ord.	£1	61/3	+4/9	20	15	4 17 7	60/-	43/-
Assoc. Elec. Ord.	£1	72/6	+1/3	20	11½*	—	62/6	41/6
Automatic Tel. & El.	£1	78/9	+3/9	15	15	—	73/-	57/3
Babcock & Wilcox	£1	78/6	+6d	18	12*	3 1 3	76/3	47/3
Baldwin, H. J.	2/-	5/-	+3d	20	20	8 0 0	5/6	3/9
Bakelite	10/-	31/3	+1/6	12½	12½	4 0 0	32/-	23/6
British Aluminium	£1	43/-	−6d	12	10	4 13 0	41/-	33/9
B.I. Callender's	£1	53/3	−1/9	10	10	3 15 1	52/-	37/9
B I. Callender's 6% Pref. ...	£1	25/-	−6d	6	6	4 16 0	26/6	24/3
British Thermostat	5/-	26/3		35	27½*	—	28/-	12/-
British Vac. Cleaner	5/-	16/9		15	25	7 9 3	14/6	11/6
Brook Motors	10/-	42/-		20	20*	—	45/6	29/3
Brush Ord.	5/-	9/3	−3d	4	6	3 4 10	8/3	3/6
Bulgin, A. F.	1/-	5/3		30	30	5 14 3	4/3	3/2
Burco	5/-	22/6		35	25*	5 11 0	21/6	12/1
Chloride El. Storage "A" ...	£1	68/-	−6d	20	12½*	3 13 6	68/6	46/6
Clarke Chapman	£1	75/9	−1/3	17½	20	—	73/-	47/6
Cole, E. K.	5/-	22/6	−1/3	25	27½	3 1 3*	20/-	11/6
Cossor, A. C.	5/-	10/9	−3d	10	10	4 13 0	11/-	7/-
Crabtree	10/-	33/9	+1/3	17½	20	5 18 6	32/-	23/9
Crompton Parkinson Ord. ...	5/-	19/3		20	20	—	17/9	11/6
De La Rue	5/-	23/6	−3d	Nil	20	4 5 0	24/-	12/3
Decca	4/-	61/3	+4/9	35	56½*	3 13 6	56/6	32/-
Desoutter	5/-	26/3		18	20	3 16 4	26/6	16/1
Dewhurst	2/-	8/-		19	24	6 0 0	7/6	5/1
Dictograph Tel.	2/-	7/3		20	20	5 10 4	8/-	5/2
Dubilier Condenser	1/-	5/-	−3d	25	25	—	5/3	3/3
E.M.I.	10/-	35/-	+5/9	8	10	2 17 2	27/9	11/3
Electrical Components	5/-	17/3		20	20	5 16 0	16/3	10/9
Elec. Construction	£1	37/-		15	15	4 1 0*	35/-	26/6
Enfield Cable Ord.	£1	23/9		5	Nil	Nil	26/3	16/6
English Electric	£1	68/9	+1/3	15	10*	—	59/-	38/-
English Electric 3½% Pref. ...	£1	15/6	−6d	3½	3½	4 16 9	16/9	15/3
Ericsson Tel.	5/-	36/-	+6d	22†	25†	1 14 9*	33/9	22/9
Ever Ready	5/-	24/-	−6d	35	40	—	26/3	17/9
Falk Stadelmann	£1	50/-		15	15	6 0 0	49/-	36/6
G.E.C. Ord.	£1	58/9	−1/3	11¼	12½	—	60/-	37/6
G.E.C. 6½% Pref	£1	26/3	−1/3	6½	6½	4 19 0	28/9	26/6
General Cables	5/-	16/9		30	30	8 19 0	18/-	16/3
Greenwood & Batley	£1	55/-		17½	17½	6 7 3	55/-	40/3
Hackbridge Cable	5/-	15/6	−3d	20	20	6 9 0	15/9	11/3
Hackbridge & Hewittic	5/-	27/6		20	25	4 15 3	25/-	16/10
Hall Tel. Acc.	10/-	12/-		10	10	8 6 8	13/-	10/6
Heatrae	2/-	5/6		12½	12½	4 11 0	5/6	4/-
Henley's	10/-	20/3	−3d	10½	10½	5 3 9	22/-	15/6
Holophane...	5/-	19/6		20	25	6 8 3	18/-	13/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

little over 4¼ per cent. Final dividend declarations are generally made in July.

A.E.I. New Shares

Dealings are in progress in the £1 new ordinary shares of Associated Electrical Industries which were issued in exchange for Siemens Bros. ordinary stockholdings. (As a result of this transaction, A.E.I. now hold practically the whole of the other company's ordinary stock.) The new shares stand in price a few pence below the old. They have the present advantage, from the buyer's point of view, of being transferable free of transfer stamp duty, but are not entitled to participate in the final dividend of 10 per cent which the company has declared its intention of paying in respect of the past year. This will make a total payment of 14 per cent, on the basis of which the current yield on the shares is 3·9 per cent.

in Electrical Investments

Company or Board	Nom. Value	Middle price 14th Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.								
Hoover	5/-	47/9	−6d	25	45	4 14 3	51/-	26/3
I.C.I.	£1	43/9	−9d	13	15	3 8 6°	43/6	26/6
Intl. Combustion	5/-	30/-		15	20	3 6 8	30/-	14/6
Johnson & Phillips	£1	52/-	+6d	15	15	5 15 5	52/6	45/6
Lancashire Dynamo	£1	60/-	+1/3	12½	14	4 13 4	59/6	43/-
Laurence, Scott	5/-	16/3	+6d	15	20	3 1 6°	4/9	7/-
Lister, R. A.	£1	37/6		12	9·3	4 19 3	33/-	22/6
London Elec. Wire	£1	57/6	+1/3	15	10°	3 9 6	54/-	38/-
Lucas, J.	£1	50/-	+6d	10·8	7½°	3 0 0	49/-	25/3
Marryat & Scott	2/-	9/9		22½	25	5 2 6	9/6	5/11
Mather & Platt	£1	57/6	−1/6	12½	15	—	53/-	32/-
Metal Industries	£1	35/6	−2/6	12	9	5 1 6	42/3	29/6
Midland Elec. Mfg.	£1	45/-		15	15	—	43/9	31/6
Morphy-Richards	4/-	29/6	−6d	40	35°	4 15 0	27/6	11/4
Murex	£1	53/-	−6d	15	15	5 13 2	57/-	49/-
Newman Ind.	2/-	3/3	+3d	10	10	6 3 0	2/6	2/-
Oldham & Son	1/-	3/3		17½	17½	5 7 9	3/4	2/5
Parnall (Yate)	5/-	12/3	−3d	6	8	3 5 4	11/-	4/3
Parsons, C. A.	£1	67/6		12½°	7½°	2 4 6	60/-	38/1
Plessey	10/-	75/-		30	20°	2 13 4	64/-	37/10
Pye Deferred	5/-	39/9		20	20°	2 10 3	37/-	15/7
Revo	10/-	14/-	−6d	27½	9°	6 8 6	20/3	14/-
Reyrolle	£1	5¼	+2/6	12½	13¾	2 12 6	92/6	66/-
Rheostatic	4/-	16/6		19	20	4 17 0	15/9	11/-
Richardsons Westgarth	5/-	14/6		15	15°	5 3 5	12/3	6/6
Scottish Cables	4/-	21/9	−6d	20	27½	5 1 2	21/9	12/1
Smith (England), S.	4/-	19/-	−1/-	15	17½°	3 13 9	17/6	7/8
Southern Areas	£1	32/6	−1/9	6	7½	4 12 4	32/6	17/6
Strand Elec	5/-	9/9		17½	17½	8 19 6	10/3	8/3
Sturtevant	5/-	24/9	+3d	18·1†	18·9°†	—	22/9	14/6
Sun. Elec.	£1	33/9		15	15	8 17 9	33/9	27/6
Switchgear & Cowans	5/-	15/-	+1/6	22½	10	3 6 8	13/7	9/9
Taylor Tunnicliff	5/-	13/3		25	12½°	4 14 3	12/4	10/7
T.C.C.	10/-	43/9	+6d	20	30°	—	41/3	21/3
T.C. & M.	£1	40/-		10	8½°	4 5 0	37/6	30/3
Telephone Mfg.	5/-	10/3		10	10	4 17 6	9/6	7/6
Thorn Elec.	5/-	35/-	−1/3	12½	20	2 17 3	30/6	13/3
Thornycroft	£1	41/3		15	15	—	39/6	26/6
Tube Investments	£1	82/6		15	17½	4 4 9	81/3	60/3
Vactric	5/-	36/3		Nil	10	1 8 9	24/6	7/6
Veritys	5/-	8/9	−3d	10	12½	7 2 9	10/6	5/-
Walsall Conduits	4/-	52/6		70	70	5 6 8	52/6	44/-
Ward & Goldstone	5/-	42/9		45	50	—	43/6	21/-
Watford	2/-	7/-		25	22½°	—	7/3	4/7
Westinghouse Brake	£1	£5		16	18	3 12 0	86/3	60/9
West, Allen	5/-	15/3xc		15	17½	—	19/6	12/7
Wolf Electric	5/-	18/6		15	17½	4 14 7	17/6	11/-
Trusts, Transport and Communications								
Anglo-Am Tel.:								
A Ord.	100	82	—1	6	6	7 6 3	89½	80
Ord.	100	52½		3⅜	3⅜	7 2 10	55½	52
Anglo-Portuguese	£1	23/9	−3d	8	8	6 14 9	25/9	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	23/6	−6d	35	50	—	24/-	13/-
Cable & Wireless:								
Ord.	£1	46/-	−1/-	9	10°	4 7 0	42/9	26/2
4% Loan	100	99½		4	—	4 0 5	98½	95½
Calcutta Trams	£1	21/-		2½†	6†	5 14 3†	24/6	17/1
Cape Elec. Trams	£1	17/-		5½	7	8 4 9	17/6	12/4
Marconi Marine	£1	35/-		10	10	5 14 3	35/-	27/6
Oriental Tel. Ord.	£1	99/-		16	16	—	101/3	82/6
Telephone Props.	£1	87/6	−2/6	—	—	—	92/6	74/6
Telephone Rentals	5/-	11/3		10	10	4 9 0	11/-	9/-

E.M.I. Issues

Stockholders of Electric & Musical Industries should now have in their hands the offer of 3 million of new 5½ per cent preference shares at 20s 6d per share, and of £2 million unsecured loan stock 1970-75 at par. These issues are open to present holders of the ordinary and preference stocks, and also of the notes, which are being repaid. Purpose of the operation is to finance the important acquisition of the majority holding in the Hollywood company, Capital Records. Meanwhile, the company's 10s ordinary shares have been giving another acrobatic display. A jump of 5s in a single day of last week took the price to 37s, after which it came back to 35s. It was 26s 6d only a month ago, and no more than 13s 6d at this time last year. American buying is said to have had a large hand in the activity.

Decca Meeting

Decca 4s shares took another big jump forward, from 56s 6d to 61s 3d, after the annual general meeting. The accounts presented were those for the year ended in March, 1954, so that in reviewing the further prospects the chairman was speaking with more than ten months of the following period already completed. Sir Cyril Entwistle was able, therefore, to assure shareholders of a further substantial increase in turnover and of another very successful year's trading. His more detailed references to the prospects of the group's varied interests impressed the market.

The Record

The chairman of Decca took the opportunity at the company's twenty-fifth annual meeting to review the present position of those shareholders who backed the company in the original issue and held on through the desperate days of the thirties. Having seen the shares, for which they had paid £1, down at one time to no more than fourpence, those shareholders who took up the various new issues now have holdings worth about 36s per share. A buyer at the peak price in 1946 now has a holding worth some 108s per original share. Similarly, each of the original £1 preference shares, which were quoted once at 2s 6d and were allotted ordinary shares in a later reconstruction, has a market value in the neighbourhood of 122s.

REPORTS and DIVIDENDS

The General Electric Co., Ltd., is to raise £10,500,000, by internal issues of loan stock and ordinary shares, for extensions, to meet the increasing costs of modernization and re-equipment of plant and buildings, and for working capital. Underwriting has been arranged by Morgan, Grenfell & Co. for an issue at 97½ per cent of £6,000,000 4 per cent unsecured loan stock, 1975-80, to preference and ordinary stockholders and holders of existing loan stock registered on 20th January. For ordinary stockholders only there is a rights issue of 1,959,240 £1 ordinary shares at 48s a share on the basis of one share for £6 of stock held on 20th January. The last date for applications for the loan stock will be 24th February. Ordinary stockholders will have until 4th March to accept the provisional allotments and to make applications for excess shares.

Burco, Ltd., and **W. H. Dean & Son, Ltd.**—Peat, Marwick, Mitchell & Co. have reported upon the appropriate basis for the exchange of shares of the two companies for the shares of a new holding company. The proposals are: For each 5½ per cent £1 cumulative preference share of W. H. Dean one 6 per cent £1 cumulative preference share of the new holding company; for each 5s ordinary share of W. H. Dean, one 5s ordinary share of the new company; and for every four 5s ordinary shares of Burco, five 5s ordinary shares of the new company. The boards of both companies have recommended acceptance and it is hoped that a formal offer by the new holding company, together with forms of acceptance for the share exchanges, will be posted to the shareholders towards the end of March.

Decca Record Co., Ltd.—Sir Cyril F. Entwistle (chairman), who presided at the company's annual meeting last week, said that the navigator business had made striking progress during the current year. The flow of contracts for new hirings and the sale of equipment had been fully maintained, and the number of fittings and contracts now covered equipment for more than 2,600 ships and aircraft. The Royal Swedish Navy had that day announced its decision to place a contract for the construction of a permanent navigational chain of Decca transmitting stations in the area of Stockholm. Perhaps the most significant commercial development during the current year had been the signing of a contract with the Bendix Aviation Corporation of Detroit, Michigan. The co-operation with Bendix opened up immense potentialities in the United States.

Orders for marine radar had increased substantially and now amounted to equipment for over 3,700 ships operated by over 870 different shipowners, governments, or authorities. The Decca airfield control radar had found wide acceptance and exports had been maintained at a high level.

A large proportion of the company's research and development capacity was engaged in work of a most advanced character as a result of contracts received from Government Departments, and large orders were in hand for production of equipment of this nature.

Electric & Musical Industries, Ltd., propose to offer for subscription to ordinary and preference stockholders and noteholders 3,000,000 5½ per cent cumulative second preference shares of £1 each at 20s 6d. per share, and £2,000,000 4½ per cent unsecured loan stock 1970-75 at par. These issues have been underwritten by Edward de Stein & Co. and Morgan Grenfell & Co., Ltd.

Allen West & Co., Ltd.—At an extraordinary general meeting on 7th February resolutions were unanimously approved providing for the issue of 2,340,000 ordinary shares of 5s each as capitalization of reserves, on the basis of one such share for every two 5s stock units held.

George Cohen, Sons & Co., Ltd., have declared an interim ordinary dividend of 3½ per cent (unchanged).

New Companies

John Keating & Sons, Ltd.—Registered in Dublin 17th January. Capital £10,000. To acquire the business of an electrical engineer and contractor carried on by John Keating at 90-91, The Quay, Waterford, as "J. J. Keating & Son." Directors: J. Keating and M. Keating, 90, The Quay, Waterford, and P. Keating.

Variators, Ltd. — Registered 5th February. Capital £501. Electro-mechanical engineers, manufacturers of and dealers in dynamos, motors, armatures, etc. Directors: V. D. Boorman, D. H. T. Deaves and G. R. Ireland. Secretary: Gertrude S. M. Perkins. Regd. office: 2, Thames House, Queen Street Place, E.C.4.

Venus & Spong, Ltd.—Registered 5th February. Capital £3,000. To acquire the business of electrical engineers and vendors of radio and television sets and other electrical equipment carried on by G. C. Venus and R. S. Spong at Ashtead, Surrey, as "Venus & Spong," etc. Permanent directors: G. C. Venus and R. S. Spong. Secretary: A. L. Lee. Regd. office: 37, The Street, Ashtead, Surrey.

Jerron Electric, Ltd.—Registered 7th February. Capital £100. Manufacturers, importers and exporters of and wholesale or retail dealers in electrical and electronic fittings and accessories, etc. Directors: J. I. Assersohn (secretary), R. H. Assersohn and P. E. Wilson. Regd. office: 36, Osborne Road, Acton, W.3.

Increases of Capital

Birlec, Ltd.—Increased by £49,000, in £1 ordinary shares, beyond the registered capital of £1,000. At 1st September, 1954, the Mond Nickel Co., Ltd., held 991 shares out of 1,000 issued. On 30th November, 1954, Associated Electrical Industries, Ltd., were allotted 43,000 shares.

Evershed & Vignoles, Ltd.—Increased by £370,500, in 200,500 5½ per cent cumulative preference and 170,000 ordinary shares of £1 each, beyond the registered capital of £120,000.

Wandsworth Electrical Manufacturing Co., Ltd.—Increased by £25,000, in £1 shares, beyond the registered capital of £25,000.

London Electrical & General Trust, Ltd.—Increased by £600,000, in £1 shares, beyond the registered capital of £600,000.

Booth & Bomford, Ltd.—Increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

Liquidations

Electrocult, Ltd. — Meeting 10th March at 99a, Park Lane, London, W.1, to receive an account of the winding-up by the liquidator, Mr. R. B. Pursey.

Wireless Relay Services, Ltd. (In voluntary liquidation).—Meeting 8th March at 16, Leeds Road, Bradford, to receive an account of the winding-up by the liquidator, Mr. W. G. Harker.

Bankruptcies

V. G. Palmer, 52, Dalgarno Gardens, North Kensington, London, W.10, formerly residing and carrying on business as an electrical engineer at 8, Tudor Close, Hove.—Public examination 18th March at the Court House, Church Street, Brighton.

N. F. Whatley, radio and television engineer, 156, Stephenson Road, Newcastle-upon-Tyne. — Public examination 5th April at the Court House, 56, Westgate Road, Newcastle-upon-Tyne.

H. F. Thorrington, electrical contractor, Eydon, Northants.—Trustee, Mr. W. J. W. Hill, 58-61, York Terrace, Regent's Park, London, N.W.1, Official Receiver, released 7th February.

W. R. Eagle, electrical contractor, lately carrying on business at 10, Houghton Chambers, 1, Houghton Place, Liverpool, and residing at 70, Eaton Gardens, Liverpool.—Last day for receiving proofs for dividend 22nd February. Trustee, Mr. E. S. Browne, 41, North John Street, Liverpool, 2.

PUBLIC LIGHTING

SOME 140 "Mazda" sodium lanterns have recently been installed in main roads at SALFORD as part of a major programme for the relighting of the city. Along Bolton Road, which is the main trunk road through Salford to the North West, the unusually wide carriageway necessitated the opposite mounting of lanterns and alternate central suspension. For this purpose traction poles were used to support the span wires, which, being very long, required all the mounting height possible. With conventional top-entry lanterns a loss in mounting height of at least 12in must be accepted, together with the inconvenience of removing the lantern for maintenance purposes. Four short-angle brackets were therefore fixed to the corners of a side-entry type lantern and secured to the span wires by "U" bolts, control gear being housed at the top of each traction pole. Cromwell Roundabout is lighted by "Mazda" sodium enclosed lanterns mounted on Concrete Utilities "Avenue 3D" columns at a height of 25ft. In Bury Old Road, Singleton Road, and St. James' Road, all main traffic routes, the lanterns are mounted at a height of 25ft, staggered at intervals of approximately 120ft.

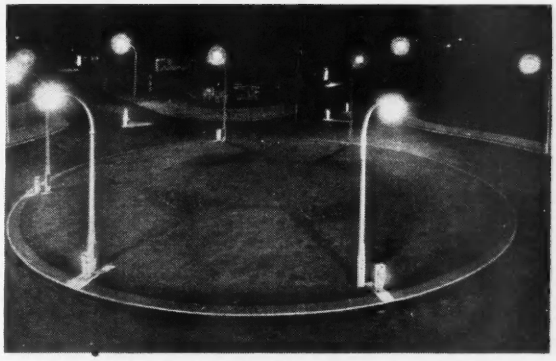
TIPTON Council, which favours mercury discharge lighting, has now been recommended by its Public Works Committee to adopt sodium lighting. For three months it had stood out for its own lighting scheme for that part of the Birmingham new road within its boundaries against opposition from Dudley and the Ministry of Transport.

To save poorer parishes the expense of street lighting, Councillor A. N. Hillier wants STAFFORD Rural District Council to consider taking urban powers for public lighting. The parish councils are at present their own lighting authorities. At the monthly meeting of the Rural District Council his recommendation that the matter should be discussed by the Finance Committee was accepted. He said that most rural councils in Staffordshire had already obtained urban powers for public lighting; in this way the costs were spread over the whole rural area.

Professor A. E. Richardson, president of the Royal Academy and a member of the Royal Fine Art Commission, visited WARWICK recently to advise the Town Council on the kind of lamp standards it should install. The Watch Committee had previously chosen concrete standards for The Butts, Northgate, Coventry Road and Banbury Road, but after touring the district Prof. Richardson prescribed tall, tapering steel standards with a single straight cross-bar and special lanterns.

OLDHAM Lighting Committee is considering converting street lighting in three roads from gas to sodium lighting. Details of the proposed scheme are: Chamber Road, cost £5,220; Frederick Street, £3,600; and Greenacres Road, £3,380.

A draft scheme for fluorescent street lighting, prepared by the Northern Ireland Electricity Board, has been approved by the COLERAINE Borough Council. The scheme provides for 545 lamps at a total estimated capital cost of approximately £31,060, with annual operating charges, including maintenance, of £2,673.



Cromwell Roundabout, Salford, lighted by "Mazda" sodium enclosed lanterns

BRADFORD Finance and General Purposes Committee has approved a provisional programme submitted by the street lighting superintendent for the improvement of lighting in various parts of the city during the financial year 1955-56 at an estimated cost of £50,000. The programme includes the replacement of existing tungsten fittings in the central area by mercury lamps.

STALYBRIDGE Lighting Committee has approved schemes submitted by the borough engineer for the provision of street lighting on the Copley estate (£3,000) and the improvement of lighting on the Hague estate (£1,600).

Plans for new overhead lighting along the Lichfield road at Shelfield are to be included in the next annual estimates of the BROWNHILLS U.D.C.

KIDSGROVE (Staffs) U.D.C. has approved a revised scheme for the provision of electric street lighting in Newchapel Ward at an estimated cost of £28,473.

PRESTWICK (Ayr) Corporation has instructed the borough surveyor to prepare a scheme for the provision of fluorescent street lighting in the main streets.

SELBY (Yorks) Council has adopted a street lighting scheme which will cost more than £20,000. The Council's share of the cost will be equivalent to a rate of about 4¾d in the £.

RAWMARSH U.D.C. is considering changing over to electricity for street lighting. At present most of the town is lit by gas.

STONE R.D.C. is seeking Ministry approval of a scheme for lighting a section of the Blythe Bridge trunk road.

WHITLEY BAY Corporation has approved the inclusion in its estimates of plans for the conversion from gas to electricity of further street lamps, at an estimated cost of £3,000.

POOLE Corporation is recommended to approve a scheme, estimated to cost £17,850, for improved street lighting in West Quay Road, The Quay, Wallisdown Road, Upton Road, Wimborne Road and Dorchester Road.

SCARBOROUGH Corporation proposes to include £24,000 in its 1955-56 estimates to cover another instalment of the conversion of street lighting from gas to electricity. The total cost of the work is estimated at £80,000.

POPLAR Works and Markets Committee proposes to improve the lighting of Bow Road, Tredegar Road and East Ferry Road, at an estimated cost of £12,640.

SWANSEA Finance and Rating Committee reports that the Minister of Housing and Local Government has sanctioned the borrowing of £15,000 for electric street lighting in various roads.

AIRDRIE Corporation has approved in principle a proposal for the conversion of all gas street lighting to electricity, at an estimated cost of £67,000.

PENRITH Highways Committee recommends the conversion of street lighting in Sandgate and Great Dockray from gas to electricity.

SOUTHPORT Lighting Committee has received loan consent for £14,245 for improved street lighting in a number of streets.

FELLING (Co. Durham) U.D.C. has submitted to the Ministry of Transport a £7,000 scheme for installing sodium lighting on 2½ miles of main road.

Improved street lighting at PETERBOROUGH is estimated to cost £8,442.

SALFORD City Council proposes to apply for sanction to borrow £10,476 for street lighting schemes.

KINGSWOOD (Bristol) U.D.C. has decided to put forward an £8,000 scheme to complete the conversion of street lighting from gas to electricity on all major roads.

SLEAFORD U.D.C. is seeking to borrow £5,000 for street lighting along county roads.

CARLISLE City Council is to spend £3,500 on the provision of street lighting on the Harraby housing estate.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 23rd March from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1949

23687. Benjamin Electric, Ltd., and Smith, H. L.—Lighting fittings. 14th December, 1950. (726652.)

1950

15906. Krefft, H. E.—Electric discharge lamp. 26th June, 1950. (726891.)

23183. Benjamin Electric, Ltd., and Studholme, J.—Electric light fittings. 20th December, 1951. (726653.)

28110. Electric & Musical Industries, Ltd. —Cathode-ray tubes employing ion traps. 12th November, 1951. (726894.)

28592. British Telecommunications Research, Ltd.—Repeaters for multi-channel communication systems. 8th November, 1951. (726895.)

29251. General Electric Co., Ltd., and Williams, C. E.—Electric circuit arrangements for varying the brightness of electric lamps. 28th November, 1951. (726654.)

1951

7939. Metropolitan-Vickers Electrical Co., Ltd.—Electronic apparatus for examining waveforms. 4th April 1952. (726656.)

25074. Loewe Opta Akt.-Ges.—Method for producing indirectly heated cathodes. 26th October, 1951. (726901.)

29412. Craig & Derricott, Ltd., and Hulbert, C. Lacy.—Snap-action electric switches. 11th December, 1952. (726902.)

30166. Pye, Ltd.—Automatic frequency control circuits. 24th December, 1952. (726903.)

1952

3516. English Electric Co., Ltd.—Rail vehicles. 30th January, 1953. (726781.)

4384. British Thomson-Houston Co., Ltd. —Electric switches. 19th February, 1952. (726907.)

5155. Metropolitan-Vickers Electrical Co., Ltd.—Reduction of noise emission from electromagnetic apparatus. 27th January, 1953. (726910.)

6213. Marconi's Wireless Telegraph Co., Ltd.—Semi-conductor amplifiers and transistors. 26th November, 1952. (726913.)

10222. Parkinson & Cowan, Ltd.—Coin-freed mechanism for prepayment gas and electricity meters. 10th April, 1953. (726787.)

10934. Svenska Ackumulator Aktiebolaget Jungner.—Winding layouts for dynamo-electric machines. 30th April, 1952. (726665.)

12483. Ray-o-Vac Co.—Electrical primary batteries. 16th May, 1952. (726923.)

12978. Winston Electronics, Ltd.—Electronic flashlight photography. 12th May, 1953. (726926.)

14255. General Electric Co., Ltd., and Neill, T. R.—Cold-cathode electric discharge devices. 5th June, 1953. (726928.)

15615. Foster Wheeler, Ltd.—Vapour generators. 22nd June, 1953. (726932.)

18210. English Electric Co., Ltd.—Electric motor control systems. 17th July, 1953. (726669.)

21259. Loewe Opta Akt.-Ges.—Electrode system for cathode-ray tubes. 25th August 1952. (726951.)

25593. Globe-Union, Inc.—Variable electrical capacitors. 13th October, 1952. (726958.)

27978. British Thomson-Houston Co., Ltd.—Electric lamps. 6th November, 1952. (726811.)

30794. British Insulated Callender's Cables, Ltd.—Packing of electric cables and other articles wound on drums. 3rd December, 1953. (726679.)

31982. Western Electric Co., Inc.—Magnetic circuits for travelling-wave apparatus. 17th December, 1952. (726823.)

32609. McMurdo Instrument Co., Ltd.—Manufacture of galvanic batteries. 21st January, 1954. (726826.)

32895. Siemens Bros. & Co., Ltd.—Automatic telephone systems. 18th December, 1953. (726969.)

33091. Borg Corporation, W. N.—Electromagnetic relay. 31st December, 1952. (726681.)

1953

61. Communications Patents, Ltd.—Automatic electric circuit keying apparatus. 1st January, 1953. (726829.)

3120. Metcalf, J. E.—Portable electric appliance for igniting coal and other solid fuel fires. 2nd February, 1954. (726552.)

3168. General Electric Co.—Electric overload protective relays. 4th February, 1953. (726978.)

3521. Heinrich, D. O.—Voltage control means. 7th February, 1953. Addition to 705604. (726556.)

5951. Compagnie Générale de Télégraphie sans Fil.—Radio direction determining apparatus for use on very high frequency waves. 3rd March, 1953. Addition to 717651. (726566.)

6330. Radio Corporation of America.—Cathode-ray tube of the lenticular grill variety. 6th March, 1953. (726569.)

6646. Standard Coil Products Co., Inc.—Television receivers. 10th March, 1953. (726698.)

7025. Compagnie Générale de Télégraphie sans Fil, Honore, E. A. H., Torcheux, E. L. G., and Roy, G. C.—Capacitors of variable capacitance. 13th March, 1953. (726576.)

7058. Moulon, J. M.—Negative impedance networks for transmission lines. 13th March, 1953. (726700.)

7337. Philips Electrical Industries, Ltd.—Circuits for producing sawtooth current. 17th March, 1953. (726989.)

7599. Helipot Corporation.—Variable resistance devices. 19th March, 1953. (726578.)

8527. Standard Telephones & Cables, Ltd.—Noise generator for very short electric waves. 27th March, 1953. (726993.)

9171. Metropolitan-Vickers Electrical Co., Ltd.—Recording in electric communication systems. 4th March, 1954. (726588.)

10469. Locher, O.—Electric cookers. 16th April, 1953. (726716.)

10919. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Deflection systems for cathode-ray tubes. 21st April, 1953. (726721.)

11082. British Thomson-Houston Co., Ltd.—Mount and bulb-loading machines for making electric devices such as incandescent lamps. 22nd April, 1953. (726724.)

11264. British Insulated Callender's Cables, Ltd.—Manufacture of electric cables. 22nd April, 1954. (726725.)

11834. Philips Electrical Industries, Ltd. —Circuits for automatic frequency control and phase modulation of electric oscillators. 29th April, 1953. Addition to 679767. (726858.)

12103. Stackpole Carbon Co.—Electric snap switches. 1st May, 1953. (726998.)

12915. Standard Telephones & Cables, Ltd.—Beam cut-off circuit for cathode-ray tubes. 8th May, 1953. (726861.)

15559. Philips Electrical Industries, Ltd. —Circuits for use in automatic telephone systems. 5th June, 1953. (726867.)

16867. Philco Corporation. — Electrical signal amplifiers. 18th June, 1953. (726746.)

17072. Vernhes, J. M.—Electric time switches for signalling circuits. 19th June, 1953. (726871.)

19100. Metropolitan-Vickers Electrical Co., Ltd.—Liquid seals for gas-cooled dynamo-electric machines. 4th June, 1954. (726621.)

19555. Müller, W.—Sound recording and reproducing apparatus for use with a telephone subscriber set. 14th July, 1953. (726624.)

21933. Greiff, T.—Clamping devices for fixing electrical conductors to insulators. 7th August, 1953. (727005.)

23606. Landis & Gyr Akt.-Ges.—Snapper for snap-action electric switches. 26th August, 1953. (726759.)

24578. Pinet, A. E.—Blocking device for channel receiving elements in pulse modulated multiplex communication systems. 4th September, 1953. (726634.)

25356. Chromatic Television Laboratories, Inc.—Method of projecting television images in colour. 14th September, 1953. (726881.)

25976. Soc. d'Exploitation des Procédés Techniques. — Electromagnetic vibratory apparatus. 21st September, 1953. (726159.)

26492. General Electric Co.—Insulating structures. 25th September, 1953. (726639.)

26688. Westinghouse Electric International Co.—Electrostatic precipitators. 29th September, 1953. (726513.)

26737. Soc. Alsacienne de Constructions Mécaniques.—End sleeves for electrical cables. 29th September, 1953. (726515.)

27096. British Thomson-Houston Co., Ltd.—Photo-electric devices. 2nd October, 1953. (726406.)

27669. Compagnie Générale d'Electricité. —Electric cables. 8th October, 1953. (726305.)

27711. British Thomson-Houston Co., Ltd.—Circuit arrangements for pulse generation. 8th October, 1953. Addition to 666574. (726306.)

27792. Chamberlain & Hookham, Ltd., Deacon, L. O., and Wharton, R. F.—Totalizing means for use with a group of electricity meters. 9th October, 1953. (726883.)

28627. Fioravanti J.—Electric insulators. 16th October, 1953. (726171.)

28813. Akt.-Ges. für Unternehmungen der Eisen- und Stahlindustrie.—Apparatus for automatically charging electric storage batteries. 19th October, 1953. (726409.)

29105. Szundy, A.—Electric dry cells and method of making same. 21st October, 1953. (726517.)

29183. Pittsburgh Plate Glass Co.—Production of transparent electroconductive article. 22nd October, 1953. (726172.)

29210. Soc. per Azioni Bassani.—Holder or fitting for fluorescent electric lamps. 22nd October, 1953. (726308.)

29442. Yamaguchi, S.—Welding electrodes for high frequency electric sewing machines. 24th October, 1953. (726885.)

29792. Telefonaktiebolaget L. M. Ericsson.—Devices for pressure sealing the ends of electric cables. 28th October, 1953. (726164.)

30324. Compagnie Industrielle des Télé phones.—Method of obtaining a harmonic from a series of periodically repeated impulses, and application of this method to telecommunication. 3rd November, 1953. (726519.)

30666. General Electric Co.—Photo-electric cells. 5th November, 1953. (726175.)

30958. British Thomson-Houston Co., Ltd.—Methods of producing ceramic to metal seals. 9th November, 1953. (726647.)

31481. Allmanna Svenska Elektriska Aktiebolaget.—Three-phase electric arc furnaces. 13th November, 1953. (726165.)

32413. Laurence, Scott & Electro-Motors, Ltd., Schwarz, B., and Schwartz, K. K.—Control arrangements for a.c. systems. 23rd November, 1953. (726166.)

32450. General Electric Co.—X-ray goniometer apparatus. 23rd November, 1953. (726886.)

32768. Immovilli, S.—Electric motor. 25th November, 1953. (726417.)

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 21st February

BIRMINGHAM.—Grand Hotel, Colmore Row, 6.15 p.m. Birmingham Electric Club. "Some Thoughts of a Control Gear Maker," by A. V. Lawry.

BOURNEMOUTH. — Grand Hotel, 7 p.m. A.S.E.E. Bournemouth Branch. "Relays and Automatic Control in Industry," by Dr. W. L. Stern.

IPSWICH. — Electric House, 7.30 p.m. Ipswich & District Electrical Association. Open forum.

LEEDS.—Town Hall, 7 p.m. I.E.E. North Midland Centre. Faraday Lecture: "Courier to Carrier in Communications," by T. B. D. Terroni.

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "The Electrification of the Manchester-Sheffield-Wath Lines, Eastern and London Midland Regions, British Railways," by J. A. Broughall and K. J. Cook. (Joint meeting with Liverpool Engineering Society.)

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. Informal lecture on "The Recent Search for and Salvage of the Comet Aircraft near Elba," by Commander C. G. Forsberg, R.N., and G. G. MacNeice.

NEWCASTLE-UPON-TYNE. — King's College, 6.15 p.m. I.E.E. North-Eastern Radio & Measurements Group. "Measurement of the Winding Resistances of a 132 kV Power Transformer in Service," by Dr. K. J. R. Wilkinson and J. D. Harmer.

North East Electrical Club. Ladies' night.

Tuesday, 22nd February

BOLTON.—Technical College, 7.15 p.m. Ministry of Works lecture. "Powered Hand Tools," by A. F. Coare.

COVENTRY.—Electricity Sports & Social Club, Merrick Lodge, St. Nicholas Street. Coventry Electric Club. "Progress in Lamps and Lighting," by H. R. Ruff.

GALASHIELS.—Douglas Hotel, 7.30 p.m. I.E.E. South East Scotland Sub-Centre, district meeting. "Electricity in the Wool Textile Industry," by A. J. Francis.

GLASGOW.—425, Sauchiehall Street, 7 p.m. Institution of Heating and Ventilating Engineers, Scottish Branch. "The Architect and Heating," by J. McNab.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre, Utilization Group. Discussion on "Power Factor and Methods of Correction," opened by W. A. Brecknell.

LOUGHBOROUGH.—The College, 6.30 p.m. I.E.E. East Midland Centre. "Nuclear Reactors and Power Production," by D. R. Poulter. (Joint meeting with the East Midland Branch of the Institution of Mechanical Engineers.)

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Measurements Group. "Electrical and Magnetic Measurements in an Electrical Engineering Factory," by D. Edmundson.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Students' Section. "Electronic Musical Instruments," by P. C. Pugsley.

Wednesday, 23rd February

FARNBOROUGH.—R.A.E. Technical College, 7.30 p.m. I.E.E. Southern Centre. Clayton Lecture: "Nuclear Reactors in Power Production," by Sir Christopher Hinton, read by Dr. J. Kay. (Joint meeting with the Southern Association of the Institution of Civil Engineers.)

GLASGOW.—39, Elmbank Crescent, 7.30 p.m. I.E.E. South-West Scotland Students' Section. "Some Problems of Analysis Encountered in H.V. Research," by L. Haddow; and "Arc Control Devices," by K. D. Srivastva.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Supply Section. "High-Voltage Transmission Developments in Sweden," by A. Rusck.

Waterloo Bridge House, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Informal meeting. "Is our Telephone Equipment too Complex?" by F. Scowen.

MIDDLESBROUGH.—Cleveland Scientific & Technical Institute, Corporation Road, 6.30 p.m. I.E.E. North Eastern Students' Section, Tees-Side meeting. Informal meeting.

NEWCASTLE-UPON-TYNE. — Neville Hall, Westgate Road, 6.30 p.m. I.E.E. North Eastern Students' Section, Tyneside meeting. Joint meeting with Students' Sections of the Institutions of Mechanical and Civil Engineers.

Thursday, 24th February

BIRMINGHAM.—West End Ballroom. Institution of Heating and Ventilating Engineers, Birmingham & District Branch. Ladies' evening.

CHELMSFORD. — I.E.E. London Students' Section, Chelmsford & District. Visit to Crompton's historical collection, Works Gates, Writtle Road, at 7.15 p.m.

GLASGOW.—I.E.S. Glasgow Centre. Annual dance.

HULL. — Y.E.B., Ferensway, 7.15 p.m. I.E.E. North Midland Centre, district meeting. "Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies on 2nd June, 1953," by W. S. Proctor, M. J. L. Pulling and F. Williams.

LONDON.—Grosvenor House, Park Lane, 7 for 7.30 p.m. Institution of Electrical Engineers. Annual dinner.

Connaught Rooms, W.C.2, 12.30 for 12.55 p.m. Batti-Wallahs' Society. Monthly luncheon, with address by N. H. Golding.

NOTTINGHAM. — Reform Club, Victoria Street, 7 p.m. Nottingham Electrical Club. "Playing with Electricity," by T. E. Hartley.

SHEFFIELD. — Grand Hotel, 7.30 p.m. Incorporated Plant Engineers, Sheffield & District Branch. "Air Pollution Problems."

Friday, 25th February

BIRMINGHAM.—College of Technology, 53, Broad Street. I.E.E. South Midland Centre, Education Discussion Circle. "Examination Regulations of the Institution," by N. C. Stamford.

Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. Annual general meeting. "Terms and Techniques for Satisfactory Lighting," by J. G. Holmes.

BRISTOL.—Royal Hotel, 6.15 p.m. I.E.S. Bath & Bristol Centre. "Brains trust." (Joint meeting with the E.A.W.)

COLCHESTER.—Red Lion Hotel. Ipswich & District Electrical Association. Ladies' night.

LONDON.—Trocadero Restaurant, W.1, 6.30 for 7 p.m. Association of Supervising Electrical Engineers. Ladies' night.

Pepys House, 14, Rochester Row, 7 p.m. Junior Institution of Engineers. Annual general meeting, followed by "Some Stages in the Refining of Crude Oil," by H. W. D. Hughes.

PETERBOROUGH. — Dujon Café, Market Place. Incorporated Plant Engineers, Peterborough Branch. Ladies' night.

WEYMOUTH.—South Dorset Technical College, 6.30 p.m. I.E.E. Southern Centre. "Demonstrations of the Principles of Modulation and of the Behaviour of Circuit Noises," by J. W. R. Griffiths. (Joint meeting with the Southern Association of the Institution of Civil Engineers.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 26th February:—

ROLMASTER. No. B735,401, Class 7. Electric motors for use in opening and closing window blinds.—J. Avery & Co. (Established 1834), Ltd., 81, Great Portland Street, London, W.1.

ELECTROMATIC. No. 736,552, Class 7. Embossing machines and machinery for use in the manufacture and repair of footwear, all being electrically operated.—Ralphs Shoe Machinery Co., Ltd., Ross Walk, Leicester.

THORN. No. 684,437, Class 9. Radio and television apparatus, gramophones, and parts. —Thorn Electrical Industries, Ltd., 105-109, Judd Street, London, W.C.1.

FALKS GLOBE-TROTTER. No. 724,551, Class 9. Electric flat irons and parts.—Falk, Stadelmann & Co., Ltd., Veritas House, 91, Farringdon Road, London, E.C.1.

PAYU. No. B730,725, Class 9. Electric vacuum cleaners and radio receiving apparatus. —Howards (Newcastle), Ltd., 14-22, Pitt Street, Newcastle-on-Tyne.

LUPUS (design). No. 736,374, Class 9. Circuit breakers; and distribution boxes, distribution boards and switchboards, all incorporating circuit breakers.—M.C.B. Co. (Manchester), Ltd., 6, Melrose Avenue, Brooklands, Sale, Manchester.

CRUSADER. No. 736,474, Class 11. Electric cooking stoves and electric water heaters, and parts.—Simplex Electric Co., Ltd., Broadwell, Oldbury, near Birmingham.

KYLCHIL. No. B736,766, Class 11. Electric heaters.—P. R. Weaver, Ltd., 14-16, Windmill Lane, London, E.15.

CATALOGUES & LISTS

INSTRUMENTS.—Leaflet on the Cambridge direct reading pH indicator.—**Cambridge Instrument Co., Ltd.,** 13, Grosvenor Place, London, S.W.1.

PHOTO - ELECTRIC CONTROLS.—Technical publication describing the "Radiovisor" photo-electric print registration unit type PR.24.—**Radiovisor Parent, Ltd.,** 1, Stanhope Street, London, N.W.1.

RADIO AND ELECTRICAL COMPONENTS.—140-page illustrated catalogue covering the "Bulgin" range of radio, radar, television, telecommunication, electronic and electrical components (194).—**A. F. Bulgin & Co., Ltd.,** Bye-Pass Road, Barking, Essex.

RELAYS.—Technical catalogue of the "4192" wired-in type relay.—**Standard Telephones & Cables, Ltd.,** Connaught House, Aldwych, London, W.C.2.

TRANSFORMERS.—20-page illustrated catalogue of the company's range of transformers for power and distribution, including air and oil cooled, and open and protected types.—**Transformer & Electrical Co., Ltd.,** Eastern Works, Eastern Road, London, E.17.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Basingstoke.—28th February. South-West Metropolitan Regional Hospital Board. Supply of electric lamps (Contract No. 6), to the Park Prewett Hospital. F. Hales, group secretary, Park Prewett Group Hospital Management Committee.

Belfast.—11th March. Electricity Department. Parallel slide valve, calorimeter, etc. (See this issue.)

Belgian Congo.—31st March. Ministry of Colonies, Brussels. Ground lighting equipment at the aerodrome at Luluabourg. (E.S.B. 2860/55. Ten/12542.)*

Bradford.—22nd March. Leeds Regional Hospital Board. Electrical installation in new single-storey villa for Westwood Hospital. (See this issue.)

Burma.—28th February. Electricity Supply Board, Rangoon. Lightning arrestors. (E.S.B. 2840/55. Ten/12538.)* Disc insulators and hardware for 11 kV transmission line. (E.S.B. 2871/55. Ten/12541.)*

Buxton.—7th March. Borough Council. Street lighting equipment. (See this issue.)

Cheltenham.—14th March. Borough Council. Trunk road lighting installations. (See this issue.)

Colne.—28th February. Peter Birtwistle Trust. Electrical work in 19 old people's bungalows, Keighley Road. J. Taylor, Town Hall.

Egypt.—23rd March. Director General, Mechanical and Electrical Department, Ministry of Public Works, Cairo. H.v. transmission lines for Middle Egypt electrification scheme. (E.S.B. 2386/55. Ten/12482.)* 12th April. Indoor step-down transformer and switching substation. (E.S.B. 2867/55. Ten/12555.)*

Great Yarmouth.—2nd March. County Borough. Electric cables for one year. (See this issue.)

Iceland.—1st March. Sogsvirkjunin, Rafmagnsveitz, Reykjavikur, Reykjavik. Two vertical shaft Kaplan turbines for direct coupling to three-phase generators. (E.S.B. 2710/55. Ten/12545.)* 15th April. Electrical equipment for Efra-Sog, Irafoss and Ellidaar power stations. (C.R.E. 3468/54. Ten/12484.)*

India.—28th February. F.O.A. India Supply Mission, Washington. Electrical apparatus and equipment. (E.S.B. 2427/55. Ten/12544.)*

8th March. Director General of Supplies and Disposals. Two electrically-driven pumping sets for oil booster station at Kandla Port. (E.S.B. 2560/55. Ten/12503.)*

Iraq.—26th February. Directorate General of Municipalities, Bagdad. Cable and cable boxes. (E.S.B. 2608/55. Ten/12498.)*

Kesteven.—5th March. County Council. Electric cooking equipment, mixing machines and vegetable peeling machines for secondary modern schools at Branston, Ruskington and Grantham. County architect, County Offices, Sleaford, Lincs.

Leeds.—7th March. Transport Committee. Supply of electric lamps for one year. A. B. Findlay, general manager, City Transport Department, 1, Swinegate.

Longbenton.—5th March. U.D.C. Electrical installations in houses. (See this issue.)

New Mills.—5th March. U.D.C. Street lighting equipment. (See this issue.)

Pakistan.—8th March. Ministry of Industries, Department of Supply and Development. Four 375 kW dual fuel (diesel and natural gas) generating sets, switchgear, etc. (E.S.B. 2393/55. Ten/12481.)* 10th March. Transformers, 15 to 400 kVA. (E.S.B. 2395/55. Ten/12480.)* 16th March. Power station equipment for Gilgit hydro-electric project. (E.S.B. 2557/55. Ten/12499.)*

8th March. Post and Telegraphs Directorate, Karachi. Loudspeaker intercommunication telephone system. (E.S.B. 2718/55. Ten/12549.)*

Persia.—1st March. Administration Générale des Chemins de Fer de l'Etat Iranien, Teheran. Installation of electrical air cooling system. (E.S.B. 2338/55. Ten/12485.)*

South Africa.—2nd March. Stores Department, South African Railways. Four one-ton air conditioning window units. (E.S.B. 2244/55. Ten/12475.)* One electric storage battery-operated fork lift truck. (E.S.B. 2243/55. Ten/12475.)* 9th March. Automatic telephone exchange. (E.S.B. 2742/55. Ten/12529.)* 10th March. Lighting fittings. (E.S.B. 2744/55. Ten/12521.)* Telephone cable. (E.S.B. 2743/55. Ten/12520.)* 17th March. H.r.c. fuse switchboard. (E.S.B. 2832/55. Ten/12531.)*

Staffordshire.—1st March. Education Committee. Electrical repairs and installations in schools in the South-East Division. Divisional education officer, Walsall Street, Wednesbury.

Strabane (Co. Tyrone).—25th February. Electrical installation in Strabane Grammar School. M'Alister & Tomlinson, architects, 6, Market Street, Omagh.

United States.—4th March. Board of Commissioners of Public Utility, District No. 1, Snohomish County. One 1,000 kVA three-phase regulator. (E.S.B. 2485/55. Ten/12501.)*

Uruguay.—29th March. Usinas Electricas y los Telefonos del Estado. Two three-phase automatic interruptors. (E.S.B. 2708/55. Ten/12525.)*

Widnes.—1st March. Borough Council. Electrical equipment for Highways Department. (See this issue.)

ORDERS PLACED

Darlington.—Education Committee. Electrical installation at the new county primary school in Abbey Road, Darlington (£1,437).—Cox-Walker, Ltd.

Flint.—U.D.C. Street lighting contract No. 2, district roads and housing estates.—Cohen Bros. (Electrical), Ltd.

Stoke-on-Trent.—Birmingham Regional Hospital Board. Recommended. Electrical installation and rewiring at the Shelton Hospital (£2,174).—T. Wood & Son (Chester), Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Birmingham.—Houses (52), Ladywood redevelopment area, and new central police garage in Duke Street, including driving school, central stores, living accommodation, etc. (£165,110); city architect, Civic Centre, 1.

Blackpool.—Dwellings (440), Grange Park estate extension; borough engineer.

Bournemouth.—Swimming pool and laundry, Kinson; borough architect.

Bridgwater.—Dwellings (130), Sydenham estate; borough architect.

Brighton.—Houses (133), flats (12), shops (4) and lock-up garages, North Woodingdean estate; borough engineer.

Bristol.—Works, Bedminster Trading estate; Arthur Scull & Sons, Ltd., 3, Princes Buildings.

Cardiff.—Swimming baths, Wood Street (£332,000); town clerk.

Coventry.—Art gallery and museum; Albert Herbert & Son, architects, 18, Friar Lane, Leicester.

Doncaster.—Technical high school for boys in Armthorpe Road (£150,000); borough architect.

Church centre at Cantley estate and new church at Wheatley Hills; Bernard Miller, architect, 39, Bluecoat Chambers, School Lane, Liverpool.

Exeter.—Oil storage depot; Shell Mex & B.P., Ltd., Shell Mex House, Strand, London, W.C.2.

Falmouth.—Secondary school, Trescobeas; Lyons, Israel & Ellis, architects, 26, Seymour Street, London, W.1.

Glasgow.—Multi-storey building, Argyle Street/Queen Street, for Littlewoods Mail Order Stores, Ltd.; J. Keppie Henderson and Gleave, architects, 196, West Regent Street.

Greenock.—Houses (148), Branchton site; Scottish Special Housing Association, Ltd., 15/21, Palmerston Place, Edinburgh, 12.

Llanidloes.—Cattle market; Gee, Walker & Slater, Ltd., Uttoxeter Old Road, Derby.

London.—Erection of out-patients' department at Lewisham Hospital (£200,000); Saxon, Snell and Phillips, architects, 9, Bentinck Street, W.1.

Office block, Holborn; Hammerson Estates, Ltd., Quadrex House, Park Lane, W.1.

Flats and maisonnettes (200), in Opal Street, Lambeth; Harry Moncrieff, architect, 73b, South Side, S.W.4.

Malvern.—Dyson Perrins C.E. School (£95,000); county architect, 14, Castle Street, Worcester.

Middlesbrough.—Church and hall, Linthorpe Road, for the Scandinavian Seamen's Mission; P. R. Middleton, architect, Albert Road.

Peterborough.—Factory, Padholme Road; W. Pinder & Sons, Ltd., King Street.

Plymouth.—Factory, Cattedown Road; Timber Construction (Plymouth), Ltd., Passage Wharf.

Warehouse, Summerland Place; J. Garrett & Son, Ltd., Embankment Lane.

Redcar.—Technical college; Collins, Melville Ward & Partners, 15, Manchester Square, London, W.1.

Rochdale.—Laboratories for Dunlop Rubber Co., Ltd.; Lear & Heywood, Ltd., Law Street, Rochdale.

Romford.—Works, North Street; Regentone Products, Ltd., Eastern Avenue West.

Rotherham.—Factory on Eastwood trading estate; William Cooke & Co., Ltd., Tinsley Steel, Iron and Wire Ropeworks, Sheffield, 9.

Swindon.—Factory, Stratton St. Margaret; Pressed Steel Co., Ltd., Cowley, Oxford.

West Hartlepool.—Assembly hall and café, Seaton Carew (£56,000); borough architect.

Wolverhampton.—Fire station, Fallings Park (£46,500); borough surveyor.

Yorks (East Riding).—County secondary school for girls at Driffield (£170,000), second section of county secondary school at Hornsea (£50,000) and completion of county secondary school at Pocklington (£55,000); county architect, County Offices, Beverley.

*Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).